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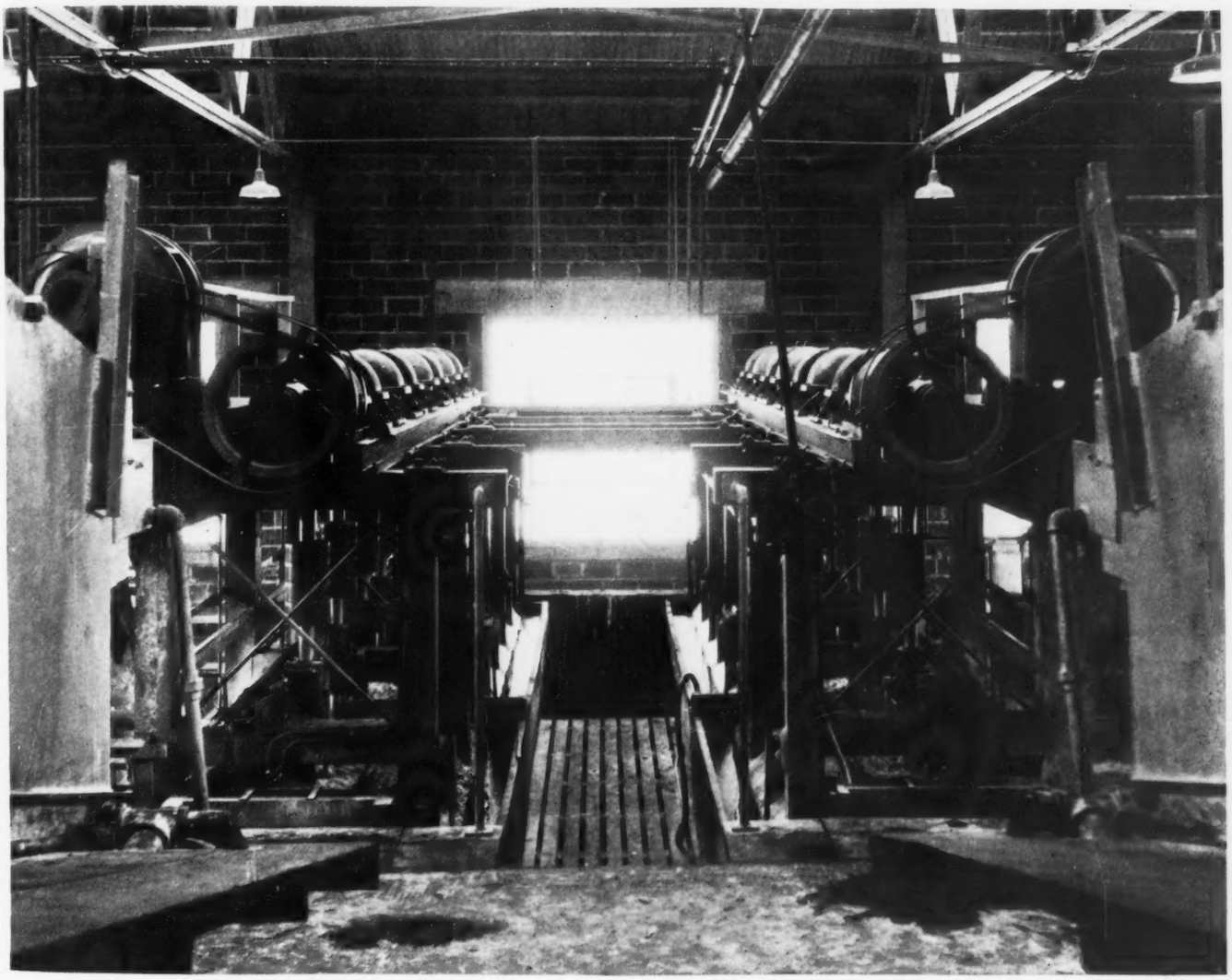
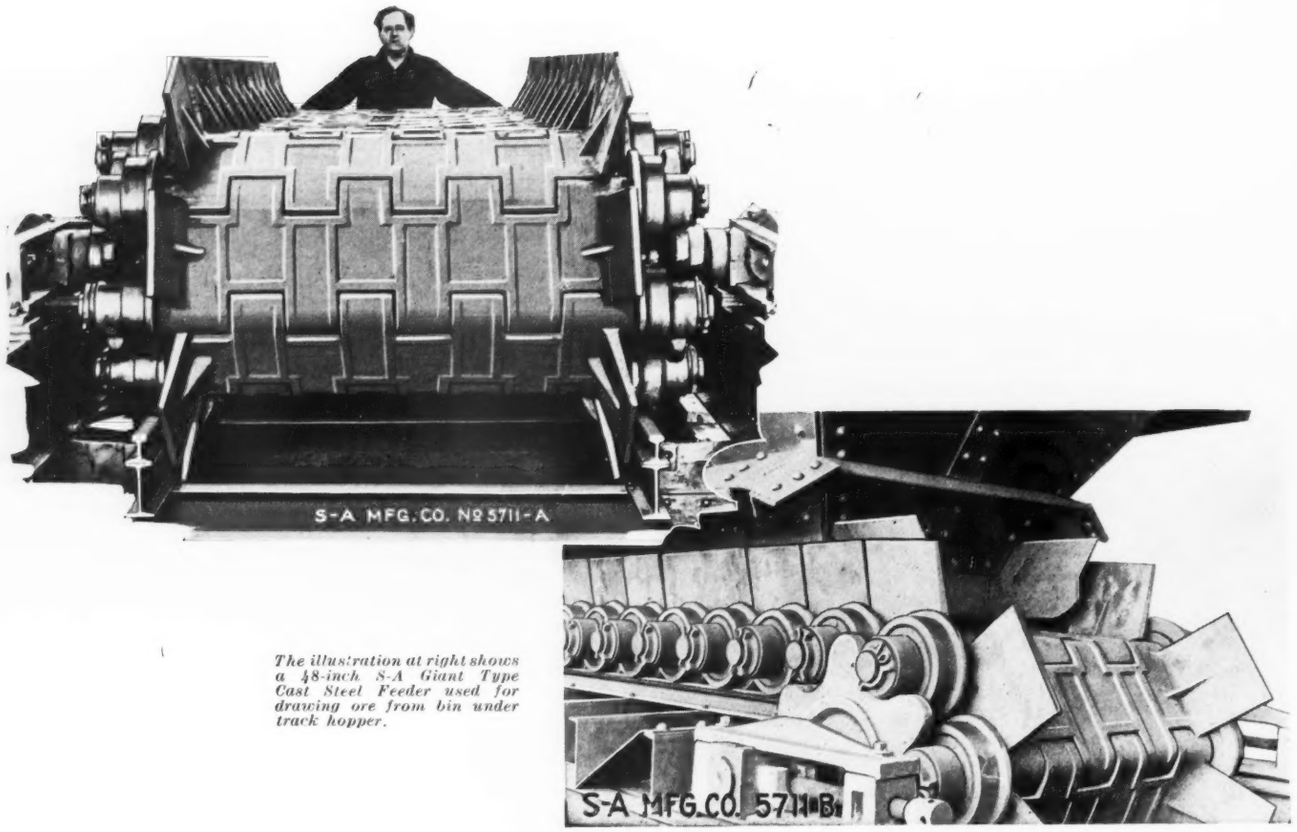


Flotation of old tailings is a feature of the Hecla Mining Company's ore treatment at Gem, Idaho. Each of the two 300-ton units of the new plant consists of a ball mill and a classifier in closed circuit, and an eight-cell flotation machine, seen above

Concentrating Lead-Silver Ore at Hecla Mine
By W. L. Zeigler

Impressions of Mother Lode Mining
By P. Bouery

Ancient and Primitive Mining and Metallurgical Methods—II
By T. A. Rickard



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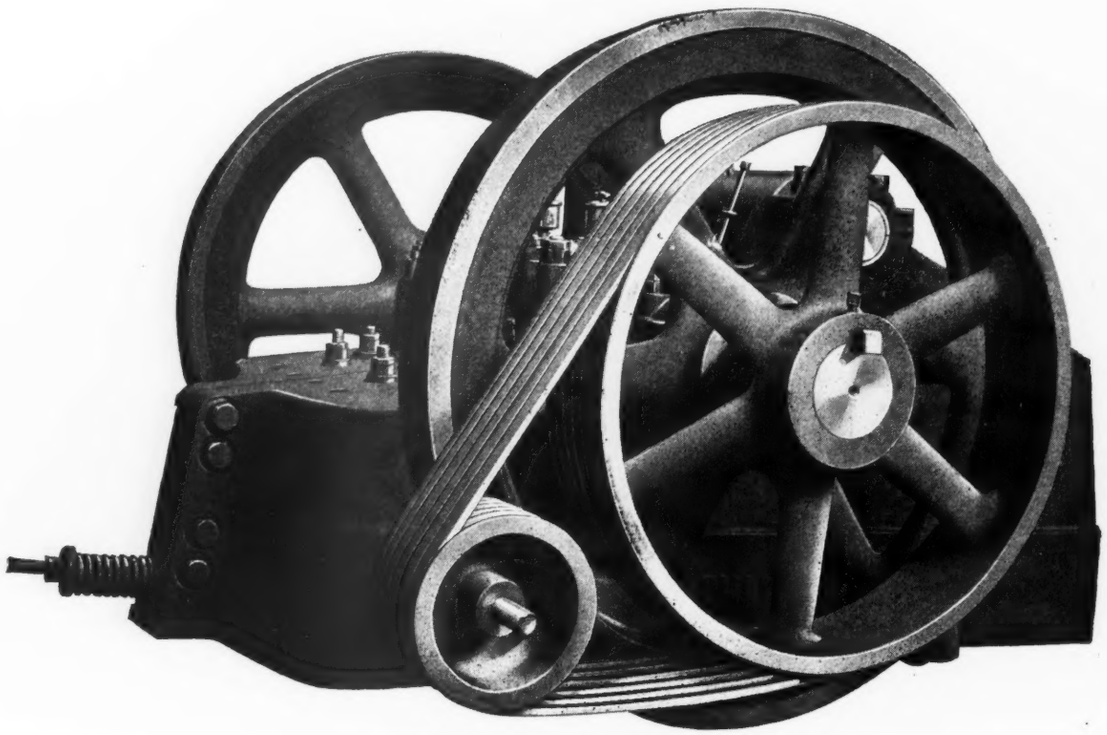

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ENGINEERING AND
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JOSIAH EDWARD SPURR, Editor

Volume 122 New York, September 18, 1926 *Number* 12

A Hundred Million Dollar Accident Hazard

THE ANNUAL REPORT of "Accidents at Metal Mines" issued by the Bureau of Mines for the calendar year 1924 has just come from the press, one year and eight months after the close of business for 1924. Of course "better late than never." Aside from the question of a belated publication, the report is a comprehensive statement of the hazards of the metal mining industry. For a period of fourteen years the Bureau of Mines has collected and published statistics, relating to employment and accidents at the mines, to be used as a basis for the study of accident prevention. Assuming that statistics do not lie, there has been but little progress in the matter of reducing accidents. For example, fatal accidents due to "falls of roof," in 1911 were 32.52 per cent of the total, while in 1924 this group embraced 31.24 per cent; "explosives" caused 11.22 per cent in 1911, and 12.24 per cent in 1924; "haulage" accidents were 7.63 per cent in 1911, and 15.79 per cent in 1924. Putting it on the basis of 1,000 300-day workers, "falls of roof" claimed 1.93 per 1,000 in 1911, and 1.65 in 1924; "explosives," 0.626 in 1911 and 0.647 in 1924; "haulage," 0.202 in 1911 and 0.523 in 1924. The fatality rate has decreased from 4.45 per 1,000 in 1911 to 3.51 in 1924. In 1913 the rate was 3.72; in 1923, 3.01, showing an erratic course, the average being 3.74 for the 14-year period, despite the efforts put forth by the mining companies, the Bureau of Mines, and the National Safety Council.

In the matter of non-fatal accidents, there has been a remarkable increase from 170 per 1,000 in 1911 to 278 per 1,000 in 1924, and an average of 230 for the 14-year period. This increase in non-fatal injuries has been due largely to the enactment of compensation laws since 1911, making it compulsory for companies to keep records, hence more complete statistics.

The open-pit mines show a steady marked decrease in fatalities from 3.91 in 1914 to 2.37 in 1924, while non-fatal injuries decreased from 217 per 1,000 in 1914 to 126 per 1,000 in 1924. Fatalities in underground mines including shaft accidents increased from 5.47 per 1,000 in 1911 to 5.86 in 1924. During this period there was a slight decrease in fatalities in the surface plants.

According to the Bureau, the time lost due to all accidents at metal mines in 1923 was 3,304,000 shifts or 9.2 per cent of the total labor performed, and in 1924, 3,074,000 or 8.4 per cent. On the basis of Henry Ford's $6 a day minimum wage, this means an economic loss of nearly $20,000,000 per year, a large part of which is sustained by the laborer and his family, and the remainder sustained by the operator or insurance company carrying the risk. This is an enormous burden to be carried by the industry, all of which must be paid by the users of copper, iron and other metals. The number of men employed in coal mines is about five times those in the metal mines, and assuming the lost-time percentage the same as in metal mines, 9 per cent, the lost-time in coal mines on the basis of 150,000,000 shifts per year would be 13,500,000 shifts, or on the same wage basis, $81,000,000 per year. With all the work done by the Bureau, the coal mine fatality rate has not changed materially, having been 4.97 in 1911 and 4.79 in 1924. There is this consolation: had it not been for the work of the Bureau, the rate might have been much higher.

While the figures indicate but a small reduction in accidents, the Bureau has shown, however, the causes and the magnitude of hazards. This known, the bad spots should be tackled with sufficient energy and financial appropriation so as to lessen this enormous human toll.

The World's Deepest Mine

WORKING CONDITIONS in the deepest mine in the world—the St. John del Rey gold mine, in Brazil, are always of universal interest. In spite of the great depth obtained, we are informed that the grade of the ore still remains about the same as it has been all the way down. The great ore shoot in the vein, starting in from the surface at a steep pitch, has shown a progressive curve, flattening out with depth. But while the values have apparently not changed, the costs of production have done so. This is, of course, notoriously true of gold mines in general all over the world, since while the nominal price of gold remains constant the purchasing power of the dollar stands about 60 per cent of pre-war potentiality. Add to that the increased charges due to working at greater depth, which is true of most deep mines, and in Brazil some special causes of increase, due to disorganization of Brazilian currency and the scarcity of labor. In the St. John del Rey handling of ore is especially expensive, because extraction is done by a series of vertical shafts and horizontal drifts connecting them. This is due to the regularly pitching nature of the ore shoot, which was followed downward in this way like a great flight of steps. Possibly there was little anticipation that the ore would go so deep: undoubtedly if what is now known concerning the extent and pitch of the orebody had been known at the beginning, it would have been far better to have sunk a deep vertical shaft and have followed the ore by drifts instead of by internal shafts and drifts. At present, however, the great expense of a deep shaft to reach even the present level of working, at 6,700 ft., apparently stands in the way of its being attempted, although if the future of the mine should be in any way comparable to the past, it would still pay to do so. But the present problem of the management seems to be to keep down working costs so as to leave

a net operating profit. Labor is scarce and inefficient. Brazilian labor is intermittent, drifting from the mines to the agricultural districts as conditions vary in attractiveness, and as wages are offered, following a habit found in most tropical countries. Attempts to import efficient European labor have failed; therefore the thought of the company has turned toward mechanicalization, just as the mine owners of the United States have long seen that the maximum substitution of machinery and good management for manual labor was the solution of their problem, in which conclusion they have but followed the tide of American industry in general. The St. John del Rey mine recently sent its chief engineer to the United States to investigate these mechanical and management devices to reduce costs, and to make it possible to produce a given tonnage with fewer men. This is the right course: and what has been accomplished in the United States, in the gold mines and in the copper mines, and in the gold mines of the Rand, may well be achieved also in Brazil. It would be unfortunate, from every standpoint, indeed, a world misfortune—if the deepest mine in the world should discontinue or even interrupt its activities (which an unsubstantiated rumor recently held was in contemplation) while the ore was still in the bottom and the values held. Science, as well as industry, demands the downward continuation of this work: for this is a type of downward pioneering which many mines, such as those of the Mother Lode in California and the copper mines of Lake Superior, will more and more have to study and follow after.

"British Goods Are Best"

ENGLISH COMMENTATORS take such pleasure in citing examples of American braggadocio—and it must be admitted that they have frequent opportunity—that one notes with some amusement that the British government seems to be somewhat boastful itself. On the letters that are now reaching these shores from London, the postal department cancels the stamp with a slogan in big black letters informing us that "British Goods Are Best." Now this is just what American manufacturers have been saying for some time about their own goods, and what the Englishman is tired of hearing. Of course, the statement is partially, and only paritally true, for any country. Every nation has certain groups of products for which it has reason to be proud. England, for example, has an international reputation for the products of its woolen mills and for its cutlery manufactures, though it is said that in the last few years not all the Sheffield cutlery deserves the name. As for mining machinery, English manufacturers also have a reputation for building things properly and ready for a long and useful life, though in design they are not always perhaps quite so up-to-date as the products of manufacturers who are closer to the places where they are to be used and thus are better able to keep track of actual operating requirements.

Narrow Stopes and Bigger Profits

SURPRISINGLY SMALL STOPING WIDTHS are being used at the Sub Nigel gold mine on the Rand. Fourteen, sixteen and eighteen inches are mentioned by the chairman in reports at recent meetings. The reef has a general dip of 15 degrees. The method followed is described in a recent number of the *South African Mining and Engineering Journal.* Comparison of the results of milling 10¼-dwt. ore from a 40-in. stope with those had with 18-dwt. ore from an 18-in. stope shows that in the former case, where much waste was broken and milled with the ore, the profit was 4s. 6d. per ton as against 25s. per ton in the latter case where the stope was narrow and the mining clean. Obviously in the latter case the tonnage crushed would be considerably less, and it seems that on the Rand big tonnages have usually been sought even though it meant milling waste. Sub Nigel's departure from this twisted view of things may be considered a sign of progress. In the "London Letter" in this issue Mr. Doman refers to this very thing. "It is strange," he says, "how periodically the alternatives of big tonnage and low costs per ton and narrow stoping and high costs per ton are brought under discussion. Now that the Sub Nigel has demonstrated what can be effected by cleaner mining, the managements of other properties are introducing the same system. After all it is not tonnage that investors want but real profits, that is, a return of capital and something in addition."

Gypsum Difficulties in California

CALIFORNIA GYPSUM REQUIREMENTS are supplied by four competitive companies. The present market is oversupplied, but instead of the companies initiating a campaign to increase demand for their product a price war is on, chiefly through (it is reported), the attitude of one of the companies. As a matter of history it is recalled that another company cut prices to as low as $13.40 per ton for hard wall plaster in the San Francisco market in 1923 but the only effect of this was to severely dent its own profits as well as the profits of its chief competitor. No useful purpose was served and this company, recognizing the futility of trying to kill competition, brought its price back to more reasonable levels. About last September one company cut the prevailing price in the San Francisco market $2 per ton bringing the San Francisco price to the present level of $13.40 per ton. This price is approximately $5.40 per ton on a mill basis at the company's plant. Obviously here again is an effort to discourage competition. It is stated that only 3 per cent of the total business of this company is in the California field and is supplied from its Nevada plant. A loss on this business will not greatly reduce the profits of the company which does business over a large part of the United States. However, it is unfortunate for the coast producers who have invested their capital in the business, on which they should obtain reasonable returns. As an instance of the business practice involved, the price cut was made retroactive on stocks in the hands of intermediates and the local companies were placed in the position of rebating the price cut to their clients who carried stocks. It is stated that the company in question had a relatively small stock in the aggregate in the hands of intermediates as compared with the local companies; thus the local companies suffered an additional penalty.

The situation has been described at some length chiefly because it points to a weakness in the nonmetallic field which has seriously disturbed the profits that should be made in these industries. It is poor business policy to cut prices below a fair margin above

production cost. In no other locality in the United States are hard wall plaster prices as low as they are on a mill basis in Nevada. From a recent Department of Commerce report on gypsum production the mill basis price for 1925 production in Nevada was calculated and found to be $6.41 per ton; in Iowa investigation showed the equivalent price to be $11.30, in Kansas $10.07, and in Texas $8.56.

The success of the non-metallic mineral industries is dependent upon a fair return upon the capital invested. A more rational method of meeting competition and of handling overproduction is necessary. Price cutting is chiefly to the advantage of the consumer and is a futile resort. Restricting production, and consistent effort to develop new uses or new markets for the product, are expedients far more worthy of attention than price cutting.

The Petroleum Report

IN MARKED CONTRAST to the forced optimism displayed by the Petroleum Institute's Committee of Eleven with regard to the future supply of oil in the United States is the concern expressed by the Federal Oil Conservation Board in its report to the President made public Sept. 8 after eighteen months' careful study. The four Secretaries, Messrs. Work, Hoover, Wilbur and Davis, who constitute the Board, think that there *is* cause for alarm in the wasteful overproduction and reckless drilling practiced by the industry at present. The Board evidently did not take the Committee's report of a year ago as seriously as did ex-Secretary Hughes, who appeared before it last spring as attorney for the Committee of Eleven, with the Committee's report written backwards, as it were, for his brief.

Only six years' supply is in reserve in the recoverable oil in pumping and flowing wells in proven sands, the Board finds. In contrast to the Committee's report the Board states that the assumption is not warranted that any large part of the so-called "billion acre reserve" will be found productive. New fields will be found, no doubt, it admits, but it says "obviously no forecast of their importance can be given." The Board throughout its report displays a greater capacity for discerning the obvious than the Committee of Eleven seemed to possess. There is little doubt, however, that the Committee can discern the obvious and can even see into a stone wall as far as any man or body, and that it was only the thought of possible Government action that made it state conditions as it did.

Constructive suggestions are made as to how the industry can help assure future supplies. Among these is that of using co-operative methods in sane development of new fields to prevent waste. This, the Board holds, deserves exhaustive discussion and is a promising field for important action by both the industry and the Government. This, it will be remembered, is the crux of the so-called Doherty plan. The Board takes the stand in regard to Government action that State legislation for the protection of all owners would be preferable, and that the Federal authority, if any, should be invoked only when it is clear that the State is unwilling or fails to act, or when naval reserves are threatened with depletion. It recommends active co-operation between the States to the end that laws may be uniform. Likewise co-operation within the industry in field work and research as well as between the Government and industry. Even more pronounced, it asserts, should be the co-operation between State and Federal officers and the Bureaus concerned.

Such recommendations were to be expected: no report on any subject can well conclude today without urging greater co-operation. Co-operation among bureaus is not difficult to effect. Co-operation within the industry among competitive interests—ay, there's the rub! But the Board has done good work in its clear appraisal of the situation. It has dissipated the fog created by the Committee of Eleven. The devising of a remedy is next in the order of business.

Libraries and Their Use

HOW MUCH USEFUL INFORMATION goes unused in industry because it is practically lost on library shelves—lost to all save those who happen to know of its existence? How many steps already taken by others in scientific progress are needlessly retraced because the record of the advance once made is sunk somewheres in the sea of literature? One has only to look at the books and files in his own vicinity and speculate on what they may contain of value to himself if only he knew just where to go to find it. In every line of human effort the library is indispensable. "The library," said Jacques Loeb, "remains the great essential to discovery." To advance, past progress must be known or else the distance painstakingly retraversed. A general program for the spread of knowledge is engaging the attention of the American Library Association. It seeks to bring industry and business into closer contact with the sources of technical information. Its knowledge and experience in library work are at the disposal of corporations and all business and scientific organizations. Its headquarters are at 86 East Randolph St., Chicago. It seeks the co-operation of the engineer and of business for the accomplishment of its program.

Dwindling Millionaires

ONLY ELEVEN THOUSAND MILLIONAIRES in this United States! How astonishing this poverty will be to those Europeans to whom every Yankee has been a man of enormous wealth! Or have the reports of the credulity of Continentals in this respect been equally exaggerated? If this statement of the Actuary of the Treasury Department be accepted at its face abroad, it may relieve a good many travelers from this country of the feeling that they must act the part of the plutocrats, and, on the other hand, may make foreign shopkeepers and tourist gougers more merciful. This will in no wise affect gross receipts: low prices mean more sales.

Once the term "mining man" carried with it in many minds the idea of great possessions and often one has been esteemed a Croesus when traveling beyond the scene of his daily work because of his association with the mine, possibly a shovel. But that was years ago. Today the "mining man" is not so glorified. In general, reported wealth and incomes dwindle under searching scrutiny. Not all Americans are millionaires indeed! Thousands of them are engineers and editors!

Concentrating Lead-Silver Ore at Hecla Mine

Jigs and Tables Retained to Make Coarse Concentrate, Desirable for Smelters—Flotation of Old Tailings Proves Great Success—Costs Unusually Low

By W. L. Zeigler
Mill Superintendent, Hecla Mining Co., Gem, Idaho

W. L. Zeigler

THE gravity concentrator of the Hecla Mining Co. was originally constructed in 1888 by the Milwaukee Mining Co., which was operating the Gem of the Mountains mine (upper workings shown in the background of the general mill photograph). It was purchased by the Hecla Mining Co. in 1900 and placed in operation two years later. At that time the capacity was only about 200 tons a day, but many additions and changes in equipment have been made so that present capacity is about 765 tons. One of the outstanding improvements made was the substitution of Callow flotation cells for vanners, which occurred in 1915. The recent building of a flotation plant for treating old tailings, and the construction of a modern surface plant at the mine, following the fire of July 13, 1923, have helped the company to maintain its reputation for economical and efficient work.

The lead-silver ore from the Hecla mine, at Burke, Idaho, is hoisted from the skip pockets on the various levels and dumped automatically into a reinforced-concrete tipple bin of about 1,000 tons' capacity. At this point is an interesting arrangement of bins (Fig. 1), facilitating the storing of waste and ore from the Star and Hecla mines simultaneously. As desired, a steel chute with a swinging apron, actuated by counterweights and an air lift, passes over the Hecla bin, and runs the material by gravity to either the waste bin or the Star ore bin. This mechanism may be raised or lowered in a short time by the skip tender, and is often switched several times during a shift, depending on the amount of material available in the mine.

From the lower part of the Hecla bin the ore passes through an air-operated gate onto a 4x8-ft. Sheridan grizzly, driven by a variable-speed motor, which acts as both a feeder and a scalping screen for the 28x36-in. Traylor "Bull Dog" Blake-type primary crusher. This crusher is set at about 5 in. opening, which is rather coarse, but at this point it is a decided advantage to hand sorting not to crush the ore too fine. Both the undersize from the grizzly and the crushed ore are taken on a 24-in. conveyor at a 16-deg. incline to the top of the sorting plant, a reinforced concrete and steel structure of sturdy design. The entire surface plant at the mine was destroyed by fire in July, 1923, and was rebuilt in the same year with this type of construction. All machines have individual motor drives, through gear reducers or belts. The normal capacity of the sorting plant is about 140 tons per hour, and enough ore is handled in six days to supply the mill for the week, with Sundays used alternately as repair days and days of rest.

Dropping from the main conveyor, the ore is diverted to two separate units by a swinging-wing mechanism. From a converging rail grizzly with 3-in. spacing the oversize slides down a chute, over a roll feeder to a sorting belt, the undersize passing over a roll feeder to a 4x6-ft. vibrating screen with $1\frac{3}{4}$x$2\frac{1}{2}$-in. openings. The oversize passes directly to the sorting belt, and forms a cushion on the belt for the large oversize from the grizzly. The undersize falls into a chute and is carried by a short conveyor to a point which will reach the shuttle conveyor, no matter what its position.

Directly in front of the coarse-rock chute, a double

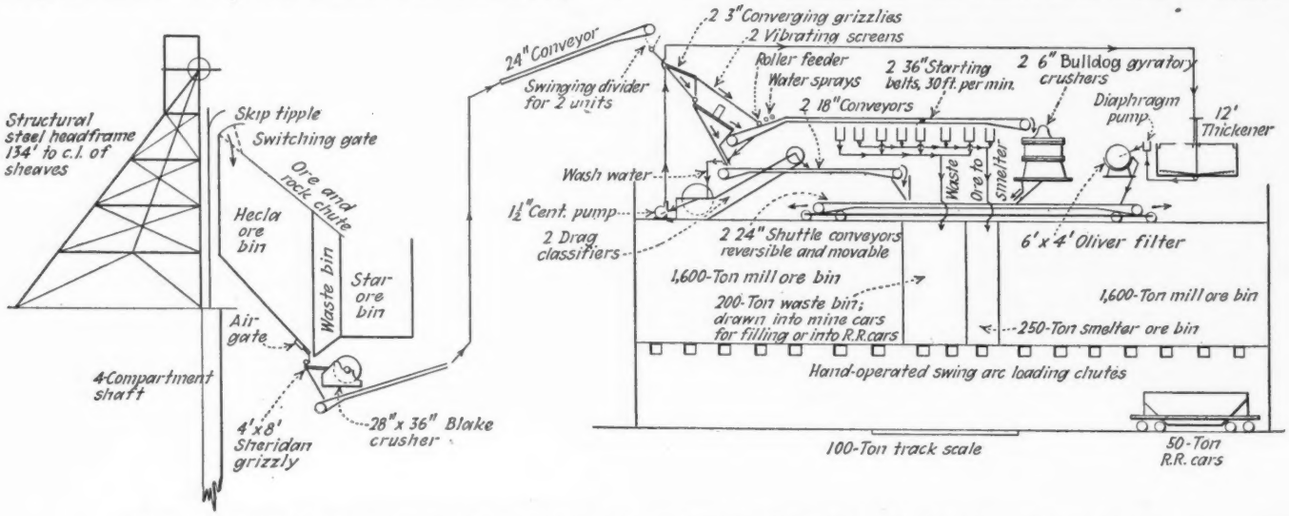
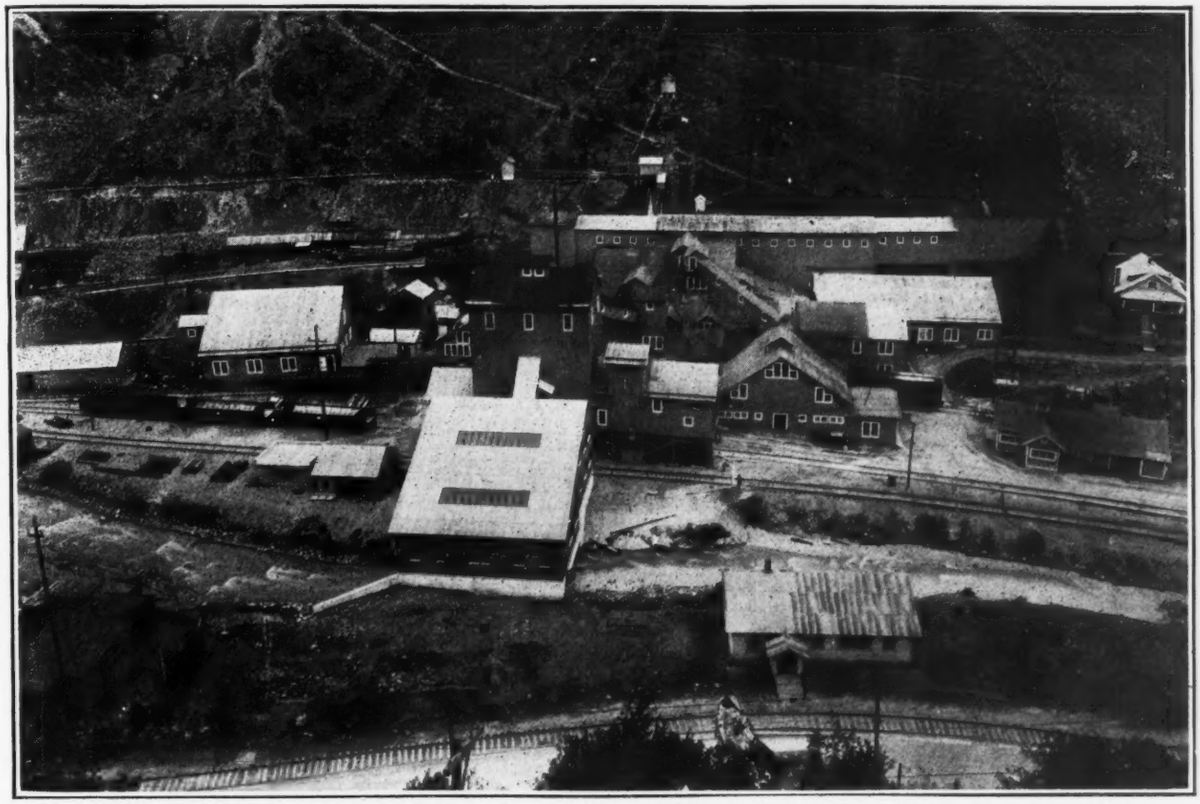


Fig. 1—Flow sheet of the crushing and sorting plant of the Hecla Mining Co., Burke, Idaho. This plant replaces the one burned three years ago

The new surface plant at the Hecla mine as it appeared last May; the headframe is seen at the right center, the sorting plant being the high concrete building to the left. The Hercules mine surface plant is in the distance



The Hecla concentrator at Gem, Idaho, three miles southwest of the mine. The new tailing flotation plant is in the foreground, spanning the creek

line of water sprays washes the oversize on the sorting belts, making the ore more adaptable for hand sorting Three men on each side of each belt pick out crude ore and waste, which are dropped into chutes and fall by gravity to their respective bins. Each ore sorter produces about twelve tons of crude ore per eight-hour shift, and each waste sorter about twenty-five tons of waste; the balance of the material on each sorting belt

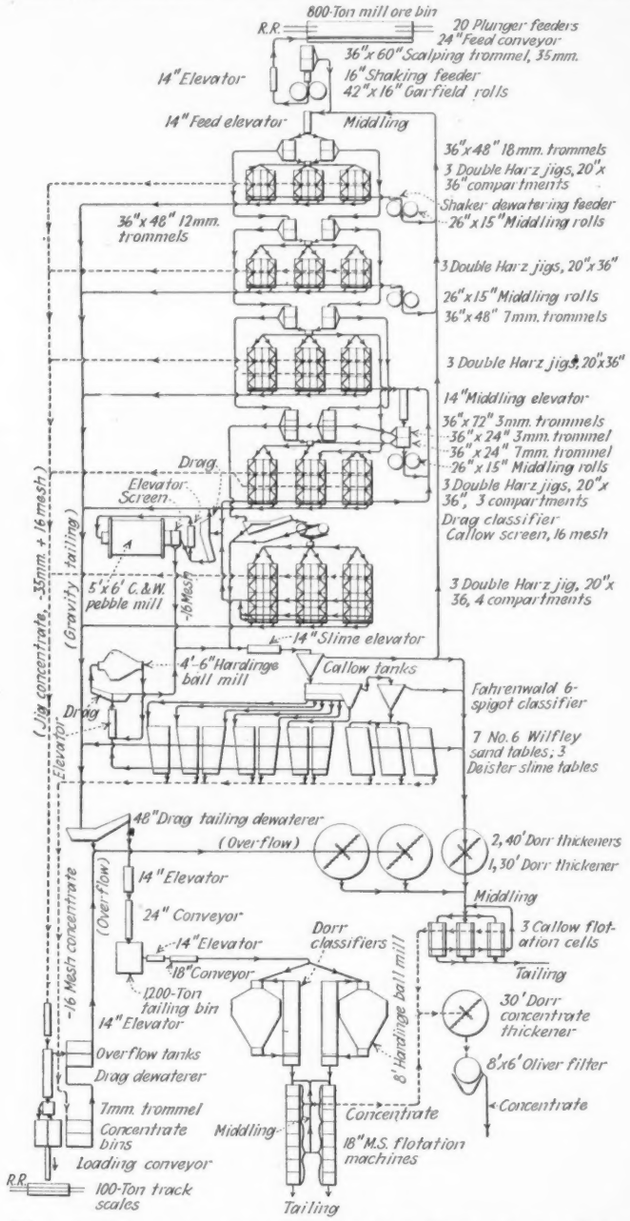
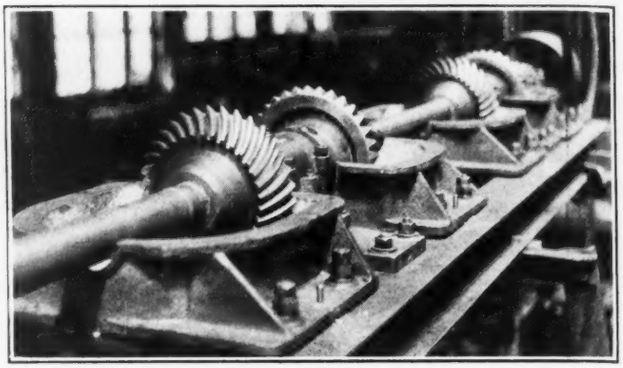


Fig. 2—Flow sheet of the Hecla mill at Gem, Idaho, showing rolls, ball mills, jigs, tables, flotation cells, and accessory equipment

is crushed in a gyratory to 1½ in. All crushed ore joins the screened undersize on a shuttle conveyor and is spread in two mill ore bins of about 3,200 tons' total capacity.

The fines washed from the belts by the water sprays are deslimed by two drag classifiers, the sand going to each shuttle conveyor and the slime overflow to a thickener. The dewatered slime is further dried by an Oliver filter, and mixed with the mill feed in the bins.

The crude smelting ore assays about 50 per cent lead and 28 oz. silver to the ton—about the same as the

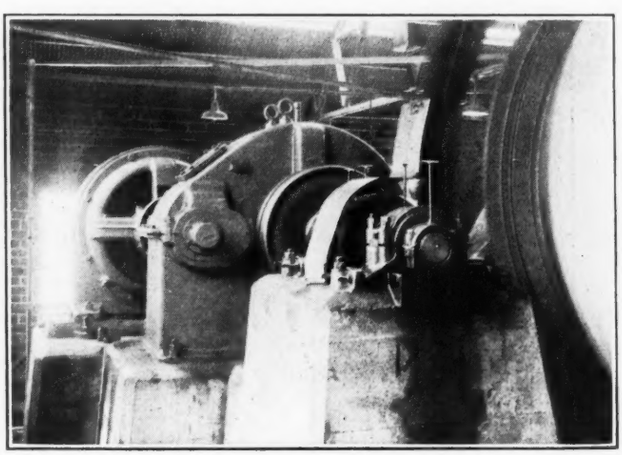


Method of driving the flotation machine impellers through helical beveled gears, thus cutting down the power required and the noise produced

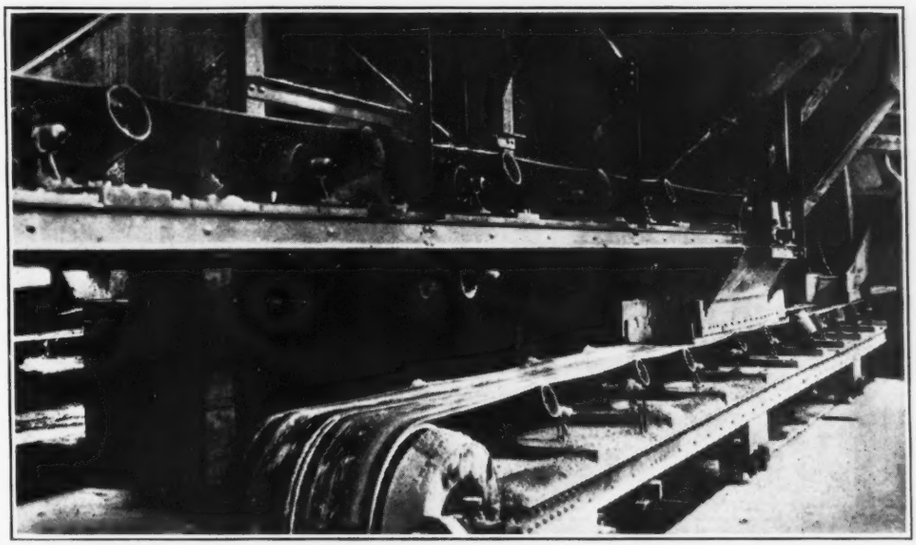
concentrate produced by milling. Not only does hand sorting of this ore give extra capacity for the operation, but it saves transportation charges of 12½c. per ton on the transfer of the ore from the mine to the mill, saves the difference between the cost of sorting and that of milling, and also the difference in losses in sorting compared with milling. The amount of crude smelting ore obtained is approximately half of the amount of concentrates produced by the mill. All the waste sorted out is practically clean of mineral and is trammed to the mine for filling in the stopes.

The galena in the Hecla ore occurs in large lenses and streaks of various thickness, and is mostly fine-grained and hard, making it an ideal ore for hand sorting and gravity concentration. The proportion of coarse-grained relatively soft galena is small. Occurring in the fine-grained steel galena are minute inclusions of quartz and spathic iron (siderite) with small quantities of sphalerite. Fortunately, these inclusions are not of a sufficient quantity seriously to impoverish the grade of the crude smelting ore or the coarse jig concentrates. The gangue as well as the country rock is a highly sheared quartzite with some quartz and siderite. Occurring with the vein is a dark-colored lamprophyric dike of varying thickness, which will be on one side or the other of ore, or sometimes in the center. This dike rock is easily spotted on the sorting belts by the waste sorters, and rarely contains any ore.

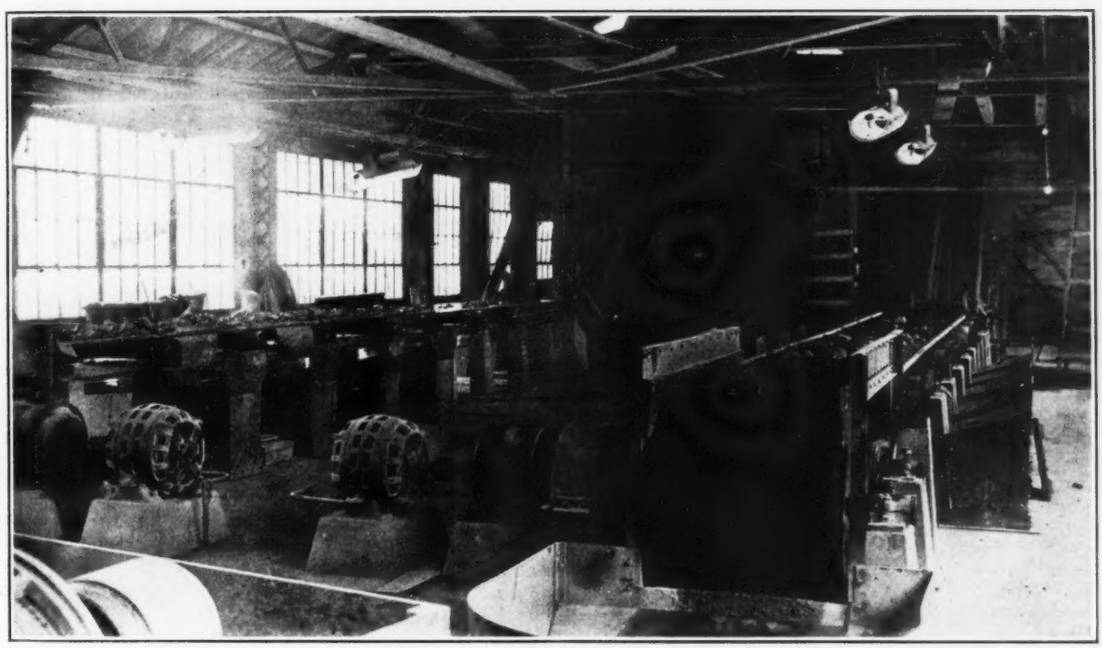
Quite a proportion of the quartzite is so intensely sheared that the original structure is obliterated, this



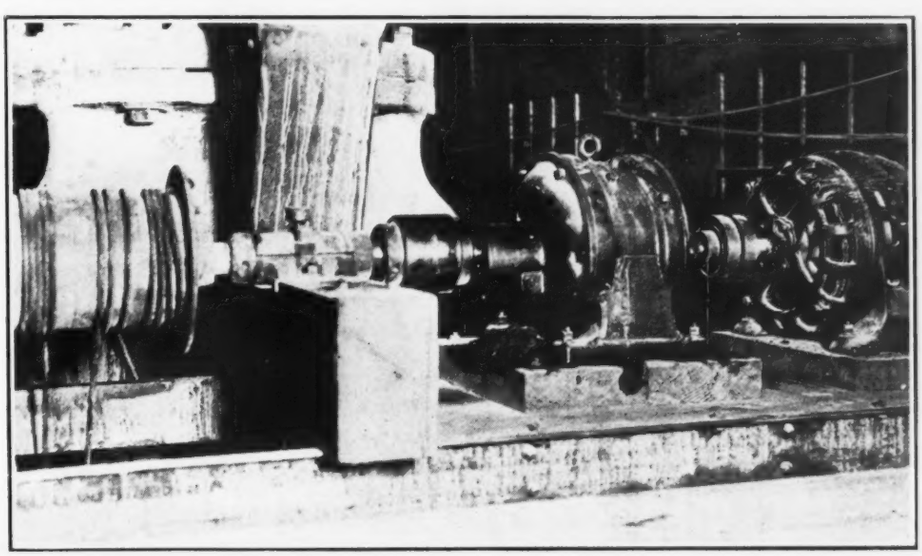
Method of driving the ball mill through a herringbone gear reducer



One unit of the movable and reversible shuttle conveyor. The gyratory crusher is at the extreme right



Picking belts, looking toward the feed end, showing driving motors



The shuttle-conveyor moving mechanism in the sorting plant

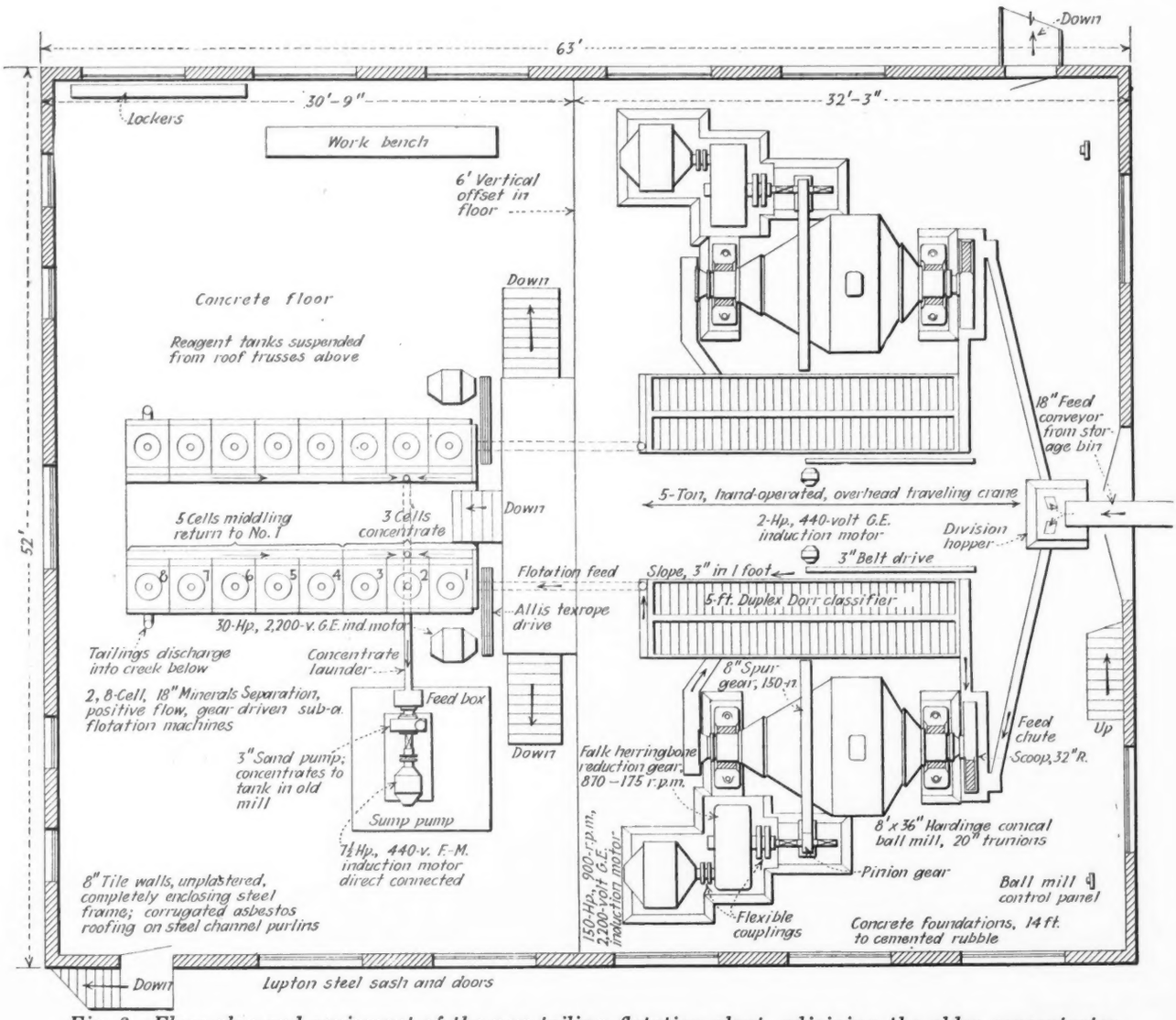

63'
Down
30'-9"
32'-3"
Lockers
Work bench
6' Vertical offset in floor
Concrete floor
Down
Reagent tanks suspended from roof trusses above
18" Feed conveyor from storage bin
5-Ton, hand-operated, overhead traveling crane
2-Hp., 440-volt G.E. induction motor
Division hopper
3" Belt drive
5 Cells middling return to No. 1
3 Cells concentrate
Down
52'
Flotation feed
Slope, 3" in 1 foot
5-ft. Duplex Dorr classifier
Allis texrope drive
30-Hp., 2,200-v. G.E. ind. motor
Tailings discharge into creek below
Concentrate launder
8" Spur gear, 150-tr.
2, 8-Cell, 18" Minerals Separation, positive flow, gear-driven sub-a. flotation machines
Feed box
Feed chute
Up
Scoop, 32" R.
3" Sand pump; concentrates to tank in old mill
Down
Falk herringbone reduction gear; 870 – 175 r.p.m.
Sump pump
8' x 36" Hardinge conical ball mill, 20" trunions
7½ Hp., 440-v. F.-M. induction motor direct connected
Pinion gear
Ball mill control panel
8" Tile walls, unplastered, completely enclosing steel frame; corrugated asbestos roofing on steel channel purlins
150-Hp., 900-r.p.m., 2,200-volt G.E. induction motor
Flexible couplings
Concrete foundations, 14 ft. to cemented rubble
Down
Lupton steel sash and doors

Fig. 3—Floor plan and equipment of the new tailing flotation plant, adjoining the older concentrator. This paid for itself in four months

feature making the ore a comparatively easy one to crush and grind. In the East orebody, which is of minor importance in the mine, the shearing is not so prominent; consequently the rock does not yield to breaking or grinding so easily as that of the main Hecla vein.

All the crushed milling ore (assaying about 7.5 per cent lead, 4 oz. silver, 7 per cent iron, 0.8 per cent zinc, and 68 per cent "insoluble") is drawn from the bins into bottom-dump railroad cars and taken three miles to the mill at Gem, Idaho. The railroad handles all the milling ore daily in two trains of seven cars each. The flow sheet of the concentrator is shown in Fig. 2. Gravity concentration is carried out so far as possible, and is accomplished with Harz jigs and tables, all sizing being done with a double line of trommels, using steel plates punched with round holes in various sizes. The ore is jigged in five sizes —35 +18 mm., —18 +12 mm., —12 + 7 mm., —7 + 3 mm., and —3 mm. + 16 mesh, each making its respective concentrate, middling, and tailing. The middling is crushed at each stage and returned to the original feed, making the recovery of all galena as coarse as possible.

All material passing through 16 mesh is classified by a 6-spigot Fahrenwald constant-density classifier, and tabled in the various sizes, making a concentrate, middling, and tailing. Table middlings are ground to pass 150 mesh, and join the original slime, which is tabled on three Deister slime tables, making a clean concentrate. Middlings from the Deister tables are pumped to a 30-ft. Dorr thickener.

The tailings from gravity concentration are dewatered in a drag classifier, and the overflow is pumped to thickeners, the underflow from which joins that from the thickener of direct slime, and is treated by flotation. The flotation tailing goes to waste, and the concentrate is dewatered by usual methods. The overflow from all the thickeners is pumped to the head of the plant and used again for jig wash water.

Flotation of Old Tailings a Feature

Formerly, the tailings were loaded in railroad cars to be used for ballast, highway surfacing material, or concrete work, or disposed of by an aërial tramway, which dumped them into another gulch. These old tailings average about 1.1 per cent lead and 0.8 oz. silver to the ton. Further treatment for the recovery of the valuable metals in them had been investigated several times with results that did not warrant the construction of a re-treatment plant; but early in 1925 experimental

work was again started with small tests, and later with a flotation test plant that treated at the rate of about ten tons per day, which showed that the tailings could be ground and treated by flotation at a profit. It was decided to make the new flotation plant an addition, rather than incorporate it in the old concentrator, the original capacity of which had been increased many times, the present arrangement being by no means ideal. The old mill buildings were of timber and board construction, making them more or less hazardous on account of fire, so all new construction was made fireproof.

Construction work on the new plant was started in the middle of July, 1925, and the plant was placed in operation early last December. The building is of concrete and steel construction with hollow tile walls, steel sash, and corrugated asbestos roofing. The lay-out of equipment is shown in Fig. 3. The ball-mill floor has for its foundation a cellular reinforced concrete block about 14 ft. deep, extending to cemented river gravel, and the cells filled with tailing to give weight to the block. Overhead, built into the steel frame, is a five-ton hand-operated traveling crane. With both ball mills running fully loaded, there is not the slightest trace of vibration in the foundations or building. The flotation floor is of reinforced concrete beam construction, and spans Canyon Creek.

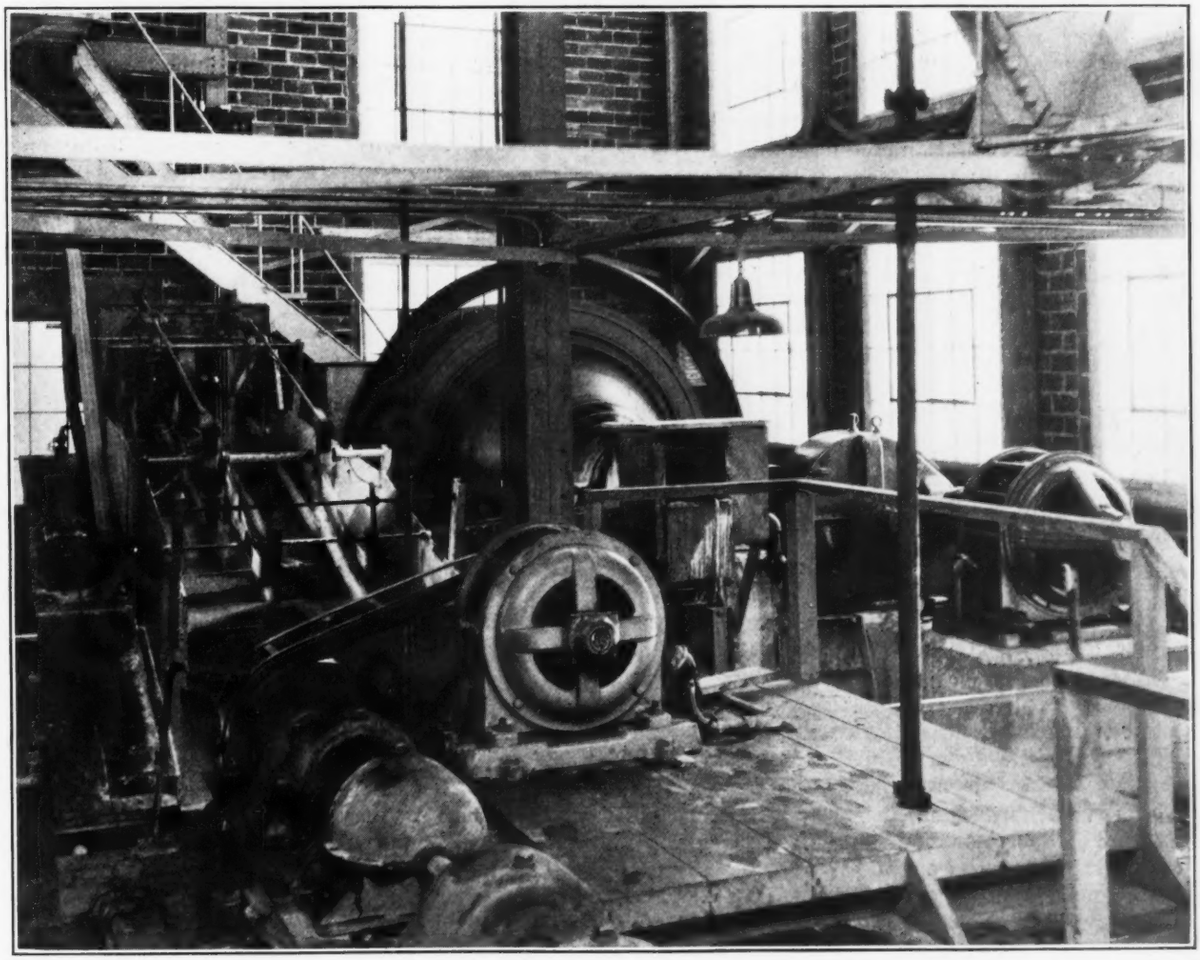
Adjustable plunger feeders are arranged under the tailing bin which feed by gravity to a 14-in. elevator, discharging to a short 18-in. conveyor. From the conveyer the tailings are discharged into a dividing hopper, from which point the plant is arranged in two separate units. Each unit consists of a ball mill in closed circuit with a classifier, and an eight-cell flotation machine, as shown in Fig. 3.

Each unit has an approximate capacity of 300 tons per twenty-four hours. One ball mill is lined with chrome steel, and 4-in. forged steel balls are added daily. The other is lined with white iron cast locally, with manganese lifting bars, and 4-in. cast white iron balls are charged. It is evident now that both types of lining will have long life, but it is yet too soon to say more.

The mills discharge by gravity to the classifiers at a density of about 65 per cent solids. The classifiers are operated at twenty-four strokes per minute, making an average sand return to the mills of about 300 per cent of the initial feed. On the overflow weir is arranged a 3-mm. screen to remove wood pulp, the screen being cleaned by rubber scrapers, which take their motion from the arms of the classifier mechanism.

The overflow from the classifiers flows directly to the flotation machines. These are driven as shown in Fig. 3 and instead of the usual construction, helical bevel forged steel gears are used, which not only reduce vibration and noise but result in a great saving of power. Ordinarily 3.4 hp. per cell is required, whereas each of these machines is operating at a total of 19.5 hp., or about 2.5 hp. per cell.

Fine grinding is not essential for high recovery of



One of the grinding and classification units in the tailing flotation plant. The tops of the flotation machines, with the rope drive from the motor, are visible in the foreground

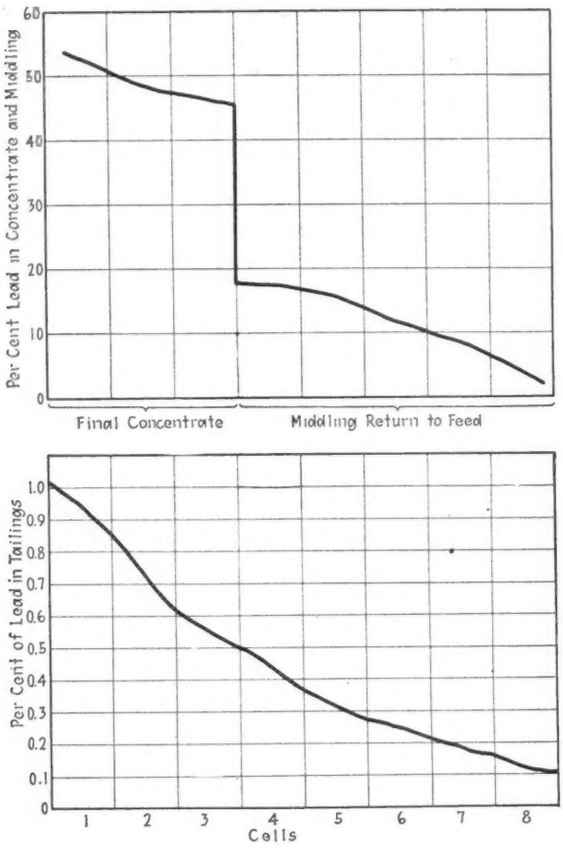


Fig. 4—Curves showing distribution of lead in the concentrate, middling, and tailing from the various cells of the Minerals Separation flotation machines

lead and silver in the flotation of the tailing, the degree of coarseness being limited principally by the floatability of the mineral particles. A sample of the final flotation tailing is as follows:

Screen Test and Analysis of Flotation Tailing

	Per Cent by Weight	Lead Assay, Per Cent
+ 28 mesh	Trace	0.1
+ 48 mesh	7.5	0.14
+100 mesh	22.5	
+200 mesh	16.5	....
—200 mesh	52.5	0.13
Total sample		0.13

Solids, 42.3 per cent.

Steam-distilled pine oil and cresylic acid in about equal proportion are the only reagents used, the requirements being about 0.05 lb. of each per ton of feed. The first three cells of each machine produce a lead-silver concentrate which will average about 50 per cent lead and 34 oz. silver per ton. The concentrate is pumped to the dewatering and filtering equipment in the old mill, and is treated with the concentrate from the primary flotation plant. All middlings from the last five cells are in closed circuit with the machine, and are picked up by the agitator in the first cell. From the overflow weir in the last cell of the machines the final tailing is discharged into the creek below the flotation floor. The operation of the flotation machines in each cell is shown by the curves in Fig. 4. The first three cells, making the finished concentrate, recover about 50 per cent of the lead in the feed. From this graph an idea of the assay of the feed, concentrate and final tailing may be had.

All electrical installation conforms with latest practice. Feeders are lead-covered cables pulled in underground conduit from a central substation, where each division of the concentration plant has individual switches with a recording watt-hour meter. Each unit in the tailing plant has its own switchboard, with an ammeter and recording watt-hour meter, so that the power consumption of each side may be balanced. All small motors are of the bearing type and are controlled by magnetic contactors operated by push buttons from various stations.

The tailing plant is operating with a wide margin of profit, owing to the low labor, grinding, and flotation reagent costs. Profits derived from the recovery of lead and silver in the tailing amounted, in about four months, to the complete cost of the plant. The Hecla milling costs have always been of the lowest in the district, the average until 1915 being about 35c. per ton, the increased tonnage taking care of rising costs of material and labor. After 1915, however, prices were so high that the per-ton cost rose to an average slightly under 50c., although a larger tonnage was milled. This cost is still an average for the gravity concentrator with its primary slime flotation plant.

The cost per ton of milling the old tailings for the first quarter of 1926 was as follows:

Labor	$0.087
Supplies (balls and liners)	.085
Flotation (reagents and supplies)	.013
Electric power	.065
Flotation royalty	.032
Total cost per ton	$0.282

Calculating this cost back against the original mill feed makes a total combined milling cost of about 70c. per ton.

At present an addition of a third unit is being made to the tailing plant. This will serve a double purpose, giving a reserve unit should repairs have to be made, and an outlet for all the milling ore if the gravity concentrator should be destroyed by fire. Test work has proved that the original mill feed is amenable to the flotation process.

At this time, of the total concentrates produced, 67 per cent is accounted for by the jigs, 14 per cent by the tables, and 20 per cent by flotation. The coarse concentrate is a very desirable one for the smelters and no doubt will continue to be a reason for using gravity concentration in treatment of Hecla ore.

Canadian Gypsum Production in 1925 Highest on Record

According to finally revised statistics, just issued by the Mining Branch of the Dominion Bureau of Statistics at Ottawa, gypsum production in Canada during 1925 totaled 740,323 tons, a new high record for this important Canadian mining industry. The value received by the operators was $2,389,891, or $3.23 per ton. In 1924, the shipments amounted to 646,016 tons valued at $2,208,108. Gypsum rock quarried in 1925 totalled 705,852 tons, of which quantity 162,820 tons or 23 per cent was calcined.

Imports of gypsum into Canada were recorded at 8,921 tons with a valuation of $136,308, while exports of Canadian gypsum amounted to 539,289 tons, consisting of 533,646 tons crude, and 5,643 tons ground, having a total value of $948,710.

Notes on Ancient and Primitive Mining and Metallurgical Methods—II

Silver in Iberia—Accounts by Strabo and Diodorus—Pliny on Refining—The Fuels Used—A Prehistoric Copper Mine—The Old Idea That Metals Grew—Early Smelting in Germany, Spain, Cornwall, Borneo and Japan.

By T. A. Rickard

DIODORUS (who wrote about 20 B. C.) tells us something about the mining of silver ore by the Iberians, the natives of Spain. Having learned the peculiarities of silver, they opened up remarkable mines, he says, and getting silver of the finest kind and in large quantity, they gained immense revenues. Their method of working the mines he describes as follows:

"There are wonderful mines of copper, gold, and silver; those who work the copper mines get pure copper out of the earth that they dig up, and some of the private individuals who work the silver mines take out a Euboic talent (27 kg.) in three days, for the entire soil is full of dust so clotted together and shining that one would wonder alike at the nature of the ground and the energy of the workers. In this way those who first lighted on these mines continued to work them, and obtained much gain through the abundance and richness of the silver-bearing earth. Afterward when the Romans became masters of Iberia a crowd of Italians overran the mines and won great wealth through their cupidity. For they bought a large number of slaves and handed them over to those in charge of the mining operations. These in many places have opened pits; they dig deeply into the earth and explore the layers of the earth that are rich in silver and rich in gold. They go down not only in length but in depth; they reach out their diggings many stadia and in various ways, excavating crooked and winding passages, they bring out of the depth of the soil that gives them gain. There is a great difference between these mines and those of Attica when compared. For those who work the Attic mines and incur great expense in their operations have not taken what they sometimes hoped to take and lost what they had, so that their ill luck seems like a riddle. But the miners in Spain heap up great wealth out of these workings, for when the first attempts have resulted favorably by reason of the excellence of the earth in this way, they even in greater degree find more brilliant veins full of silver and gold, the whole earth near by having been twisted up in many ways with the interlacing of the veins. And sometimes even in depth they happen upon rivers running under the earth whose violence they master by diverting their flow by transverse drains, for under the pressure of unfailing expectations of gain they carry their attempts to an end. And the strangest thing of all, they drain these flowings of water by the so-called Egyptian screw, which Archimedes of Syracuse invented when he went into Egypt. By means of these continuously in succession passing the water forward to the outlet they dry the bottom of the mines and make it handy for the business of digging. The machine is a remarkably clever one, for by ordinary effort it is able to lift endless water in a surprising way, and the whole flow of the stream is poured out of the depth into the open country. One would naturally admire the inventiveness of the craftsman not only in these matters but in many others of more importance famous all over the world, about which I shall speak in detail when I come to the period of Archimedes."[1]

Mines Unwatered by Archimedes Screw

The Iberians learned about silver from the Phoenicians, who came to Spain and engaged in a lively trade with them. Apparently they found metallic copper in the surficial parts of the veins, for Diodorus lays emphasis on the fact that they obtained "pure" copper out of the earth. Strabo, quoting probably from the same source (probably Posidonius) as Diodorus, says native metal, the chloride (kerargyrite), or the sul- which they extract from the copper mines is pure copper." This may mean either that this proportion of the output is in the form of native copper or that the copper content of the ore averages 25 per cent. The Greek historian charges the Romans with greed, so the Romans, in turn, imputed excessive love of gain to the Phoenicians; each people in turn imputed cupidity to those with whom they found it difficult to compete in trade. The description of vigorous exploration in depth is that of a man inexperienced in mining, so we need not infer that the workings were more than one or two hundred feet deep. The comparison with the Attic mines is taken from Posidonius, whom Strabo likewise quotes, thus:

"Discoursing on the diligence of the miners, he (Posidonius) applies to them the remark made by Demetrius of Phalaris, who, speaking of the silver mines of Attica, said that the men there dug with as much energy as if they thought they could grub up Plutus himself. He compares with them the activity and diligence of the Turdetani (the Iberians of whom Diodorus wrote), who are in the habit of cutting tortuous and deep tunnels, and draining the stream that they frequently encounter by means of Egyptian screws. As for the Attic miners, their mining (he, Posidonius, remarks) may be justly compared to that enigma, 'What I have taken up I have kept, and what I have got I have thrown away'."

This enigma, or riddle, of Homer refers to the story of the fishermen who came to the beach to sell their fish, which they lost, and when they departed took with them only the fleas they had caught from the sand. Aesop's fable of the dog who lost his bone by snatching at its reflection in the water is analogous.

Demetrius of Phalaris was a pupil of Aristotle and founder of the library at Alexandria in the days of Ptolemy Soter. Another version of his remark reads as follows: "To see these men digging into the earth with so much ardor, one might suppose that they hoped to dig out Plutus or Pluto himself."

Romans Used Water Wheels

Archimedes of Syracuse was in Egypt in about 200 B. C., when he invented his screw as a means of conveying water. This method was clumsy and slow, so the Romans introduced the use of wheels, operated by slaves, for raising water to successive levels until it was delivered into a drainage adit. Such a water wheel was found in the northern workings of the Rio Tinto mine, near Huelva, in Spain; and to this wheel were hanging the fragments of the ropes by which the slaves kept it in motion. In a neighboring mine, the San

[1]Not the standard translation, but one that I owe to the aid of T. R. Glover, of Cambridge.

Domingos, were found nine similar wheels (14½ ft. in diameter) in series along a gallery that inclined at about 40 deg., the water being lifted successively until it reached a place where natural drainage became feasible.

Diodorus, referring to placer mining in Gaul, says:

"Silver, generally speaking, is not produced, but much gold, which nature yields to the natives without mining or distress, because the rivers get full of gold-dust by flowing in crooked ends and washing against the slopes of the mountains and breaking off lumps. Those engaged in this kind of work gather these together and smash the lumps that have the dust, and by means of water they wash away the gold and hand over the rest to be fused in furnaces."

Strabo also quotes Posidonius in regard to the washing operations of the Artabri, in the northwestern corner of Spain, where "the earth is powdered with silver, tin, and white gold, that is, mixed with silver, the earth having been brought down by the rivers; this the women scrape up with spades, and wash in sieves, woven after the fashion of baskets." Strabo quotes a reference of the historian Polybius (135-51 B. C.) to the silver mines near New Carthage, the modern Carthagena; he says:

"The silver ore is collected and then broken up, and sifted through sieves over water; what remains is again broken, and the water having been strained off, it is sifted and broken a third time; the dregs that remain after the fifth time are melted, the leading poured off, so that the silver is afterward pure."

This describes a rough process of concentration in successive stages, and the subsequent separation of the silver from the lead by liquidation—or by cupellation, if we assume that the lead was in the oxidized condition, namely litharge. As the richer pieces that were not pulverized by crushing remained on the sieve, it is to be inferred that the silver mineral was malleable, either native metal, the chloride (kerargyrite), or the sulhide (argentite).

Lead's Part in Extracting Silver

The recovery of silver by aid of lead is mentioned by Pliny; he says:

"The earth in which it (silver) is found is sometimes red, sometimes of any ashy hue. It is impossible to melt it, except in combination with lead or with galena, this last being the name given to the vein of lead that is mostly found running near the veins of the silver ore. When submitted to the action of fire, part of the ore precipitates itself in the form of lead, while the silver is left floating on the surface like oil on water."[2]

The use, in the standard translation of Pliny's "Natural History," of the word "precipitate" is another example of a glaring anachronism, for "precipitate" has a precise modern meaning in any chemical or metallurgical context. In the original the Latin word is *discedit*, a proper translation of which would be "comes away" or "separates"—only that, and nothing more. The Romans had no word for tin until a much later period, so in Pliny's time they distinguished it from lead by calling it white, *plumbum candidum*, whereas lead was black, or *plumbum nigrum*. Usually Pliny designates lead ore by the word *molybdaena*, which is from the Greek word for lead (*molubdos*); and he uses galena as equivalent to our word litharge, or lead oxide. In the next chapter, he describes the smelting of an ore containing both silver and lead:

"The metal that first becomes liquid in the furnace is called *stannum;* the next that melts is silver; and the metal that remains behind is *galena*, the third constituent part of the mineral. On this last being submitted to fusion black lead is produced, with a deduction of two-ninths."

Stannum is what we call "work lead" and the Germans call *werk*, the silver-lead alloy from the first smelting operation. The word *stannum* was not employed for tin until the days of Festus Avienus, in the fourth century. Various renderings of "galena," as used in the above passage, have been given, and I agree with Ajasson that it must be litharge. Elsewhere (Vol. XXXIV, p. 53) Pliny says that it has a golden color. He remarks:

"Molybdaena, which in another place I have called galena, is a mineral compounded of silver and lead. It is considered better in quality the nearer it approaches to a golden color and the less lead it contains; it is also friable, and of inordinate weight. When it is melted with oil, it acquires the color of liver. It is found also adhering to the furnaces in which gold and silver have been smelted, and in this case it is called metallic."

Here we see some of the difficulties arising from a description of a technical process by a layman; it reminds one of the articles on mines and smelters that one reads today in the newspapers.

What Fuel Was Used

In regard to the fuel used in these metallurgical operations, Pliny says[3]: "For melting copper and iron, pine wood is the best, Egyptian papyrus being also very good for the purpose. Gold is melted most easily with a fire made of chaff." Both straw and the reeds from the Nile valley would give a fierce fire of brief duration. Pliny repeats his remark: "Though proof against the most intense fire, if made with wood charcoal, it (gold) will melt with the greatest readiness upon a fire made of chaff; and, for the purpose of purifying it, it is fused with lead." Strabo says[4]: "Gold is most easily melted by straw, the flame of which is soft; whereas coal, besides wasting a good deal, melts it too much by reason of its vehemence and carries it off in vapor." Here again the Hamilton translation is guilty of an anachronism, for the Greek word *anthrax* should be translated "charcoal," not "coal" because stone fuel was not used in the operations described by Strabo. Jones gives "charcoal-fire" as the translation, but the original does not mean that; it means plain "charcoal," the fuel of primitive smelting all over the world from time immemorial.

"Lofty" Stacks to Carry Off Fumes

Strabo makes the interesting remark that "the furnaces for silver are constructed lofty, in order that the vapor, which is dense and pestilential, may be raised and carried off. Certain of the copper mines are called gold mines; which would seem to show that formerly gold was dug from them." The building of chimneys high enough to carry away the malodorous and destructive fumes from the smelting furnaces will remind the modern metallurgist of the so-called smoke suits, the lawsuits brought by farmers, or alleged farmers, against smelting companies for damages done to their crops or animals, or both, by the sulphur and arsenic liberated into the air during the roasting of lead and copper ores.

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[2]Natural History, Vol. XXXIII, p. 31.

[3]Op. cit.: Vol. XXXIII, p. 30.

[4]Geography, Vol. III, pp. 2, 8.

Strabo's observation concerning the copper mines that had been gold mines is in accord with modern experience, for many mining districts that at the time of their discovery were the scene of gold-mining operations are now known for their yield of the base metals. The veins of the Butte district, in Montana, for example, were worked for gold when their outcrops were discovered, and subsequently they were productive of silver, before, at a lower horizon, their copper contents became the determining factor in making them of great economic importance. Similar instances can be cited from other parts of the world.

Old Copper Workings in Spain

A prehistoric copper mine was discovered in northern Spain in 1888. The manager of certain mines at Mieres, in the Alamo mountains, noticed that the leaves of a tree were agitated violently on a still day, so he was prompted to investigate the phenomenon, and found that a current of air was coming from an abandoned shaft. Further examination disclosed a series of ancient workings, consisting of a number of small vertical shafts connecting with galleries and stopes of considerable extent in which pillars had been left to support the roof. Several veins of copper, in dolomite, had been followed by the ancient miners, who, in the walls of their galleries and the filling of their stopes, had left the traces of the implements and the methods they had employed. Their attention, probably, was first attracted by the native copper and rich nodules of the black oxide that occurred in the outcrop of the vein that later they followed into the ground. A fall of roof had buried one of these old miners with his tools, which included a deerhorn pick, also a deerhorn hoe, and the burr of a tag's antler that had been used for breaking the mineral. The ancient miners had also used stone implements for driving their gallery, tines of the deer for dislodging the mineral, and stone mauls for breaking it. The underground passages were small, and their sides, rubbed smooth by the leather smocks of the diggers, showed that they had been long in use. The ore, which was broken into small pieces in the mine, was taken to the surface in wooden hods, to which was attached a leather ring to serve as a handle for dragging it along the ground where the passage was too constricted to allow it to be carried on the shoulder. The workings were lighted by torches or resinous wood inserted in balls of clay that were fixed to the rock walls.

When Metals Grew

The ancients had a curious idea that the metal in mines grew if left alone, and therefore that mines became enriched during periods of idleness. Some such idea appears to persist to this day among local quidnuncs and the sellers of mines in our old mining districts. A mine that has been under water for long seems to gain in reputation as a source of possible wealth. Among the ancients this idea may have arisen partly from their inability to distinguish inorganic from organic matter, and to the belief that ore deposits were essentially shallow and therefore identified with the soil. Later this notion of natural accretion was strengthened by noticing the formation of stalactites and observing the encrustations on the faces of abandoned workings, as well as the impregnation of wooden implements by metallic salts, all of which gave rise to the conception of organic growth, and a consequent confusion of ideas between mineral and vegetal substances. We know now, it is true, that mineral deposits increase by deposition from the chemical solutions that circulate underground, but we realize fully that the concentration of ore at any given place is due to a process so slow as not to be effective within the lifetime of a man.

Theophrastus believed that stones beget stones. Aristotle records the story that at Philippi, in Thrace, "there are mines the refuse of which increases and produces gold." To this he adds the remark that they say "It is an observable fact." Again, in his "De Mirabilibus Ausculationibus," he writes: "They say that in Cyprus, at the placed called Tyrrhias, copper is produced in like manner; for men having cut it up, as it appears, in small pieces, sow it, and then, when the rains come on, it grows and springs up, and is so collected." Some of this yarn may be ascribed to the green stains produced by the oxidation of the copper during the rainy season. The same celebrated author, Aristotle, makes another note on this subject. "They state also," he says, "that in Pieria, a district of Macedonia, some uncoined gold was buried by the ancient kings, and, although there were four cavities, from one of them gold grew up a span in length." Evidently the "uncoined" gold, like an unpeeled potato, had the power to grow when planted underground. Again, in the same collection of sayings. we are told that in Pæonia, when continuous showers have fallen, there is found what is called "gold without fire." The word here used is *apuron*, which means native gold needing no refining. Evidently the showers had washed aside the silt or sand and caused the gold to lie exposed; as today, in many gold-mining districts, the small boys go in search of particles of gold immediately after a rainstorm has passed, knowing that the effect of the falling and running water is to expose the gold to view. Aristotle suggests that the rain had made it grow.

Vain Imaginings—Enrichment by Rumor

The stalactites and stalagmites in abandoned marble quarries led to vain imaginings. Pliny says: "Among the other marvels, too, of Italy, we are informed by Papirius Fabianus, a most diligent enquirer into the operations of Nature, that the marble there grows in the quarries, and those who work in the quarries assure us that the wounds inflicted upon the mountains fill up spontaneously." Here apparently a reference is made to the settling of the ground and the consequent closing of cavities or the filling of openings that had been made in the course of quarrying the stone. Javolinus writes of the *lapiducinæ (marmoreæ) in quibus lapsis crescere possit*, or quarries in which the stone has the power of growing again. Later Ulpian likewise refers to the quarries in which the stone is renewed by growth, in Gaul and in Asia Minor. Pliny makes another mention of this phenomenon; when speaking of the lead mines in Spain he says:

> "It is a remarkable fact that these mines, and these only, when they have been abandoned for some time, become replenished, and are more prolific than before. . . . This was lately found to be the case with the Santarensian mine, in Baetica, which, after being farmed (leased) at an annual rental of 200,000 denarii, and then abandoned, is

[5] "On the Use of the Deerhorn Pick in the Mining Operations of the Ancients," by Horace W. Sandars, "Archaeologia," Vol. LXII, p. 2.

now rented at 250,000 per annum. In like manner, the Antonian mine, in the same province, has had the rent raised to 400,000 sesterces per annum."

The mines of Santarem are not in Baetica, the modern Andalusia, but in Lusitania, the modern Portugal. Pliny's statement may remind some of us, for example, how the old Eureka mine, at Sutter Creek, became so enriched, by rumor, that it was sold, after being long idle, to a group of experienced mine operators for half a million dollars, in 1915. The sequel proved that the story told at Sutter Creek in California was no more true than the ancient yarn retailed at Santarem, in Lusitania, about 1,900 years ago.

The first silver that was found is likely to have been in the metallic state, as were the other metals, gold and copper, that primitive man used in the beginning. Most of the silver obtained by the Greeks and Romans, however, was derived from lead ores, chiefly galena. This mineral if placed in a hot fire would lose its lead by volatilization, leaving the silver behind in beads of white metal. Some of the silver, moreover, in Spain, for example, was probably derived from surficial lumps or patches of the chloride, kerargyrite, the modern miners' hornsilver, a name that perpetuates the Greek meaning; for *keras* is horn and *arguros* is silver. This silver chloride would be reduced readily to the metallic state on a charcoal fire.

Camp Fire the First Reduction Works

The first reduction of ore to metal was done in a camp fire, which became a smelting hearth by the making of a hole in the ground as a receptacle for the ore and the fuel. The early settlers and hunters in Missouri noticed the lead ore exposed at the surface and learned quickly how to obtain metal for shot and bullets by building a fire in the hollow of a fallen tree or in an old stump, smelting the pieces of galena that they had gathered.

It was found that the wind increased the heat of the fire, so it was started on the side of a hill in the path of the prevailing wind. A trench was dug up the slope to conduct the air from the fire, this trench serving as a rudimentary chimney. Bruce describes[6] some Roman lead furnaces in Cumberland that obtained their draft through a tapering tunnel driven into a hill. It is probable that some of the ancient furnaces were like those used for extracting bismuth from its ores during the sixteenth century as described by Agricola.[7] A trench, in sloping ground, was filled with brushwood, on which logs were laid. The wood was set on fire, and when the trench was full of glowing embers the ore was thrown upon them. More wood was added at intervals. The molten metal ran into a hole at the lower end of the trench, which was so placed as to be in the path of the prevailing wind, this being the only blast used in the operation. Pryce tells us of the remains of tin hearths in Cornwall, these consisting of mere holes in the ground, into which a charcoal fire was made before the tin ore was placed upon it, to be reduced by aid of the blast from a bellows. Primitive man learned at an early stage how to obtain pulsations of air by means of the alternate influx and compression of air in a bellows made from the hides of the animals he killed for food. In the Belgian Congo the natives make this bellows, for the smelting of copper ore, out of two bottles of antelope skin, each of these having an opening of two inches at one end, and at the other a transverse aperture eight inches long, the lips of which are rendered rigid by means of rods of bamboo sewn to the hide. This aperture functions as a valve, which is opened and shut by the movement of the operator's hand. He lifts the bottle and at the same time admits the air, which he forthwith compresses; then he closes the valve and expels the air at the other end, through a tube (or tuyère) of wet bark into the furnace.

Smelting Tin Ore in Borneo

The natives of Borneo used to smelt the tin ore in the same way as they had been accustomed to smelting their iron ore. All the metals were smelted by primitive man by the one process of a hole in the ground and the reducing action of burning charcoal. In Borneo the natives dug a hole twelve inches wide and threw burning charcoal into it; then handfuls of ore and charcoal alternately, the ore being smelted by aid of a blast delivered through two pipes of bamboo that passed underground. This blast was produced by a wooden piston set in the vertical hollow of a tree trunk, into the lower end of which the bamboo tubes opened.

J. A. Phillips describes[8] a crude method of tin smelting among the peasants of Zamora, in Spain, as observed by him in 1856. He found a family jointly at work; the small children were collecting the stones of ore lying on the surface of a ploughed field and were bringing them in reed baskets to a shed, where the ore was broken with a hammer on a big stone. The pieces were sorted by a big brother, while the mother threw the selected material into a furnace, alternately with handfuls of charcoal. The father blew the bellows. The furnace was a cylindrical receptacle, 10 in. in diameter and about 2 ft. in depth, in the middle of a cubic yard of rough masonry constructed without mortar. This furnace was lined with clay. On the side toward the prevailing wind a screen of masonry had been built to the height of 2 ft., so that externally the structure resembled a chair built solid to the seat, inclosing a chimney pot extending from the middle of it nearly to the floor level. A blast was delivered from an old pair of bellows, placed behind the screen of masonry, the tuyère being inserted about 4 in. above the bottom of the furnace. The tap hole, on the opposite side, was kept open. The charcoal was made from the roots of a heather that abounded in the locality. No flux was added. The metal and slag as they issued from the tap hole were received in a piece of a cast-iron pot. Only a small proportion of slag was made, and it was removed with an iron crook as it cooled in the pot. When sufficient tin had accumulated in the pot it was cast into strips in a sandstone mold.

Primitive Hearth Improved

The building of a stone wall on the fringe of a hole made in the camp fire was the first improvement of the primitive hearth. The furnaces of the ancient Egyptians on the Sinai peninsula, where they produced copper for twenty centuries, were holes 18 to 25 in. deep, with stones built into a rough low wall around the periphery. When in Japan, sixty years ago, Gowland saw several smelting operations that indicated the character of the process used by the ancients. For ex-

[6] "The Roman Wall," p. 432.
[7] See Hoover's translation, p. 433.
[8] "Thoughts on Ancient Metallurgy and Mining," "Archaeological Journal," 1859.

ample, when smelting copper ore, the natives of the interior prepared a floor of clay, 2 ft. thick and 4 ft. square. In this tubular mass a shallow conical hole, about 2 ft. in diameter, was scooped. The hole was then lined with 3 in. of damp clay mixed with broken charcoal, this mixture therefore being of a porous structure. The workers were protected by a wall of wattle, or interlaced branches, daubed with clay. No aperture was provided in the hearth either for admitting a blast or for tapping the metal. Air under pressure was supplied by a pair of bellows placed behind the protecting screen, the air passing through a tube of bamboo that terminated in a long nozzle, made of clay that had been molded on a rod of bamboo. The nozzle rested on the edge of the hole, or hearth. A small fire was started to dry the lining of the hearth, which was then filled with charcoal. When this fuel was burning freely, a layer of fresh charcoal was added, followed by a layer of ore, then more charcoal, and so forth, alternately, until a conical heap of ore and charcoal stood upon the hearth. The bellows were set to work vigorously and the ore was reduced slowly, the charcoal meanwhile being consumed, until within an hour the entire heap had sunk into the furnace cavity. The unconsumed charcoal and the slag that covered the molten copper were then removed by aid of a wooden rake. The metal itself was not ladled; a little water was sprinkled upon it with a straw brush, causing the outside to solidify; then it was lifted by means of a hook, and carried on a shovel to be thrown into water. Later the copper was re-melted in a clay crucible.

Again these primitive Japanese used the methods of classic antiquity. A fire was made in the crucible (not outside) and above it; the crucible was then placed in a simple hole in the ground, the space between it and the sides of the hole, or hearth, being filled with coarsely powdered charcoal. Lumps of ignited charcoal were put into the crucible and piled over it in a conical heap. The bellows was started, pieces of copper were placed on the heap of charcoal at a level above the place where the nozzle of the bellows entered, and more charcoal was heaped upon the copper. The metal, as it melted, trickled through the charcoal to the bottom of the crucible and accumulated there. When the operation was completed, the crucible was lifted and its contents were poured into a mold. This was made of canvas set in a trough of hot water, the copper being poured into the canvas through the water. The effect of the heat on the crucible was seen, Gowland remarks[9], only on the upper rim and interior, as in the crucibles left by the ancients.

Early Tin Smelting in Japan

William Gowland, formerly professor of metallurgy in the Royal School of Mines, found a primitive tin-smelting furnace in use in the Japanese province of Satsuma when he was traveling there in 1883. He says that the ore was broken roughly by hammers upon stone anvils, and then reduced to a coarse powder by means of a kind of foot-stamp, such as was used also for decorticating rice. This contrivance consisted of a beam weighted with a stamp, shod with iron, lifted by leverage applied by the operator's foot and suddenly released so that it dropped upon the ore. The mortars were large blocks of stone in which recesses or hollows had been roughly fashioned. Then the ore was reduced further, to a powder, in stone querns, or hand mills, after which it was washed by women standing in a stream. Thus the earthly and barren matter was separated from the pure ore. The furnace resembled that used in copper smelting, as described above, except that it was of smaller diameter. The ore was charged while still wet, in layers alternately with charcoal, and the operation that followed was exactly the same as that performed in the smelting of the copper ore. The tin when smelted was ladled out of the furnace into molds of clay, which were flat slabs in which long and narrow depressions (or grooves) had been made, the resulting ingots having the shape of rods. The entire yield of a single charge was only 30 lbs. of metal, much of it being lost by volatilization and also by entanglement in the slag.

The primitive methods of crushing ore, before washing or smelting it, were based upon the aboriginal practice in grinding corn, so that the ancients used rubbing and bucking stones, pestle and mortar, hand mills or querns. In Korea in 1884, the gold ore was crushed by rocking a large boulder, with a slightly curved bottom, upon a larger one that was set in the ground with its flattened surface uppermost and nearly level. The movement of the upper stone was effected by means of two poles that were lashed to it, the rocking being done by four men laboring at the ends of the poles. At the sites of ancient gold mines in Egypt the remains of the stones, upper and lower, that constituted their querns, or hand mills, are numerous.

[9] "Early Metallurgy of Copper, Tin and Iron in Europe," "Archaeologia," Vol. LVI, p. 2.

Germany Increases Production of Crude Amber

Germany, which possesses the most commercially profitable amber deposits known to exist, produced 497 metric tons of that material in 1925, as compared with 442 tons in 1924; 397 tons in 1923, and 360 tons in 1922, according to the Chemical Division of the Department of Commerce. The industry produces raw or crude amber chiefly, marketing it to refiners for the manufacture of smoker's articles and amber ornaments. Surface deposits occur above Koenigsberg, in East Prussia on the so-called Samland coast on the Baltic Sea. Two coastal villages, Palmnicken and Kraxtepellen, lead in production.

The German amber industry was acquired by the Prussian State in 1899. Since 1924 it has been operated by the Prussian Mining and Smelters Co. (Preussische Bergwerks und Huetten A. G.), which is the sole producer at present. Pre-war production from surface "blue earth" on the Samland coast amounted to about 400 metric tons annually. During the war it dropped to only one-fifth of this amount. Since 1922 pre-war production has been bettered. Installation of modern mining apparatus on the Palmnicken deposits permitted the increased production in 1925.

The crude amber which does not enter the market directly is processed by smelting and briquetting to pressed amber. In the period from 1913 to 1925, only 144 tons of amber was so treated. Furthermore, amber smelting yields, as commercial byproducts, succinic acid and oil of amber (oleum succini) used by the paint and chemical industries. Production of smelted amber amounted to 1,572 tons in the period from 1913 to 1925; oil of amber, 526 tons; and succinic acid, 55 tons.

Columbia, one of the old placer towns. Note the exposed dolomitic bedrock left by early miners

Mining on the Mother Lode in California*

As Seen by an Hydraulic Operator

By P. Bouery

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FINDING MYSELF recently with a few days at my disposal while awaiting certain decisions as to future activities in the northern part of California, I decided to take advantage of an opportunity to revisit parts of the Mother Lode region in the foothill counties, both to add to my knowledge of that region and to get in touch with conditions there. Leaving San Francisco on May 4, 1926, I arrived at Jackson (Amador County) in the evening. The next morning I presented to Mr. McGee a letter of introduction given me by Mr. Solinsky. He was very amiable and cordial, but did not give me much encouragement as, outside of the quartz mines, the Argonaut and Kennedy, mining was practically at a standstill and nearly all placers were lying idle or had been exhausted.

That same evening I took the stage to Volcano, 12 miles distant. The name of Volcano is appropriate, as the town is built in the bottom of a valley, oval in shape, with only one outlet, Sutter Creek, while several other creeks empty into it from different directions. It is a suitable site for a reservoir of immense capacity when the need for one will arise and when the few remaining inhabitants will be willing to leave the town. Volcano was prosperous in the early days.

In the morning I went to the Elephant mine, at the head of Soldier's Creek, reached by a steep wagon road passing near the French mine (today the Cleveland). In the early days it was worked by the hydraulic method and finally as a drift mine; as the tunnels were too high, the present owners dug a tunnel below the road to tap the channel at its bottom. Two men are working now, but still have several hundred feet to dig before they can run the mill. This mill is of the rotary type, of small capacity, run by an old Ford engine ingeniously coupled with the pinion on the mill.

The Elephant mine, on the top of the hill, is an hydraulic mine worked with the water diverted into the Volcano ditch, which is 28 miles long and of a capacity not exceeding 2,000 miner's inches. This mine was worked in the early days and was abandoned after the enactment of the Anti-Debris Act. Since that time a retaining dam has been built and operations resumed on a small scale. One giant with a 4-in. nozzle under 225 ft. head is used to wash the gravel and carry the tailings to the dump. There is little surface gravel, the lava reaching nearly to the top. Beneath are limestone boulders and between them the gold-bearing gravel with no large boulders. The mining is expensive, as it is impossible to displace the boulders and much of the work has to be done by hand; the tailings are carried into two sluice boxes, from which a tailrace about 100 ft. long takes them to other boxes of the same size (3x3 ft.) but 520 ft. long, paved with blocks, and then dumped into the retaining dam a few

*This article is a letter from one mining man to another and embodies the results of observations made upon a reconnaissance trip through the foothill region of California. The letter was not intended for publication but permission to publish was obtained.

hundred feet below. Apparently the duty of the miner's inch is low and although the gravel runs as high as 45c. (so I was told), I doubt that the method of working pays the cost of recovering the gold. This gold, smooth and coarse, is of high fineness, and different from that coming from an adjacent pit where the gold is also coarse but angular and full of quartz. The specimens I saw were beautiful and should tempt one to operate the mine by more efficient methods. The mine is under a "fifty-fifty" lease, the owner assuming all expenses for supplies, lumber, pipe-lines and care of ditch. During my visit they were preparing for the general cleanup to complete which will probably take five or six weeks, as everything is done with scrapers, hoes, wheelbarrows.

Union Flat Mine Reopened

Leaving this mine I followed the pipe line, which is about a mile long, and went to the Union Flat mine (Budan mine) which belongs to the same owner and has been leased on the same terms as the Elephant mine. Situated near the bottom of the gulch, it was opened up last spring and little gravel has been washed. The volcanic ashes colored with ocher are near the surface and the gold-bearing gravel is mixed with them. A limestone dike crosses the pit and, according to the legend, it is a good indication, as "where there is limestone there is gold." The equipment is very primitive, a 3-in. nozzle under a pressure of 125 ft. being used against the bank, which, although not hard, breaks only when caved; five boxes of sluice are supposed to collect the gold, while the tailings are carried into the retaining dam of the Elephant mine.

Between these two mines numerous hydraulic pits can be seen, with immense boulders of limestone in evidence, indicating that there has been great activity in the past and that the town of Volcano enjoyed real prosperity.

As no other mines were in operation I left the following morning and returned to Jackson; to the left of the road I noticed the old Reward mine idle for years; its owner confessed that he could never make it pay in the past but that it undoubtedly would pay under capable management. To the right is the Dane and Mitchell mine, abandoned because the neighbor refused the right to follow the ledge under his ground and the owners had no more money to continue and drift in another direction along the vein. This mine is for sale. A shaft 200 ft. deep and two levels constitute the only work done on a 14-ft. ledge; a ten-stamp mill with tables was in operation while it was worked. The ore left in the neighbor's ground when the owners quit runs $40 a ton, I was told. If this is true, I do not see why the owners should want to sell.

Three miles from Volcano is the small town of Pine Grove ideally located for a resort, being among pine trees and on the highway; from there to Jackson there is no agglomeration, only a few ranches.

The next morning I left for Mokelumne Hill, 8 miles away; along the road I saw the old town of Butte City, where the Butte hydraulic mine was located, also the diggings of the old timers; nothing is left except the ruins of the town and a few patches of meadows with a farm-home at the upper end of the hill.

Before crossing the Mokelumne River I went to Electra, a power station of the P. G. & E. A 1,200-acre reservoir supplies the water to the turbines under 1,460 ft. head, generating 20,000 hp. at 2,300 volts stepped up to 60,000. The three pipe-lines delivering water are of 42 and 30 in. diameters.

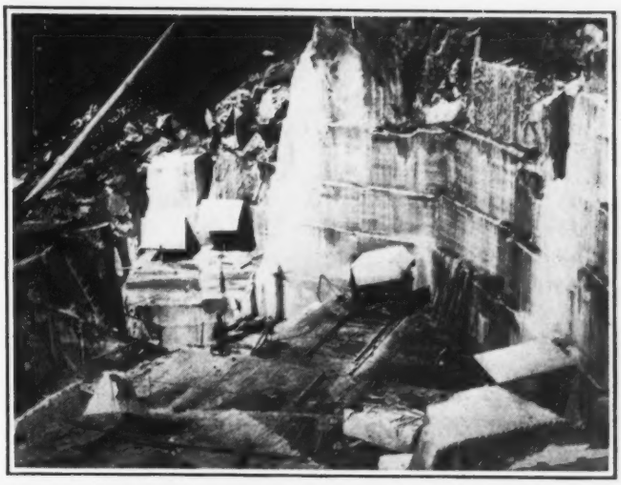
The shaft that is being sunk now by Mr. McSorley near the Old Flume Barn and bonded at present to a Los Angeles party will have a total depth of 400 to 450 ft. through lava before reaching the channel which is supposed to extend into the Buffalo ground.

At Mokelumne Bridge I met Mr. Tom McSorley and his brother John and we devised a program for the next day. The following morning on my way to meet them I visited the Duryea hydraulic mine, which was stopped by the Anti-Debris Act, and from there to the McSorley home. We soon were on our way and shortly arrived on the Buffalo ground after stopping a few minutes under the General Fremont oak tree on the Bernardi ground adjoining the Rooney and Buffalo grounds. While walking to the Buffalo Mr. McSorley told me that there was still $3,000,000 of gold left in Chili Gulch in and under the tailings of the Duryea property lying there.

Walking to the shaft I saw the old Hughes incline. Its entrance is concealed by brush, and the office as well as the head frame over the shaft are in a very dilapidated condition. Nothing of the old stamp mill is left except the castings. The shaft being full of water I could not see the condition of the sets underground, but believe that they will have to be renewed. An old timer living there told me that he panned some of the tailings every winter and made sometimes as much as $2 to $3 a day, which shows that the mill did not save all the gold.

On the left of the road to the Buffalo is the Rooney shaft, which is in the same condition as the Buffalo shaft and of no use except in case of consolidation of the properties. Such consolidation seems not only wise, but for true operating economy, inevitable.

From the Buffalo shaft we went to the reservoir and from there to the new shaft of the What Cheer. I do not think well of the use of the reservoir, except for washing the gravel, because power could be bought more cheaply from the P. G. & E. than it could be generated. From the shaft we went to the old Marcus Daly shaft, which was unwatered once by John McSorley, but probably the results were not satisfactory, as the mine was shut down and all machinery taken away. Mr. McSorley spoke also of his work on the new two-compartment



Marble quarrying near Columbia

shaft dug under his direction to a depth of 220 ft. From there a crosscut was started and finished by his successor.

From all that I could learn, it is certain that the Buffalo mine needs a new opening, either a new shaft on the Buffalo ground, or the use of "What Cheer" shaft, if a consolidation of both properties is feasible. My impression is that it will be more economical to use the "What Cheer" shaft than sink a new one.

Mokelumne Hill is too well known to insist upon its past. I was told that the majority of the original population was French; Chileans, Italians and men from the South with their slaves followed. Each claim on the old channels was 16x16 ft. and only one claim was allowed to each individual, excepting the slaves and peons who were only allowed to work for wages. Five dollars were paid for each load of gravel brought to the river to be washed. Exceedingly rich ground was found; in French Hill three acres of ground yielded $12,000,000 or an average of $25,000 per claim. French Hill was so rich that disputes arose for its possession and "war" was declared between the French and the gambler outlaws who coveted it.

At Mokelumne Hill—One of the pioneer buildings

An important outcrop of quartz can be seen over this ground and McSorley told me that he intended to sink a shaft to find the origin of the gold, as according to his views the gold was deposited there not by transportation but by years of erosion.

Around Mokelumne Hill they are doing development work on three quartz mines, the Boston, the Lampier, the Easy Bird. A new company was recently organized in Los Angeles which is developing the Boston on different lines.

The Lampier mine was opened up by Frenchmen, but lack of money stopped the work; they sold it to the Sperry flour interests of Stockton, who leased it to bankers, oil men from Los Angeles who are now sinking a shaft 200 ft. deeper. When the French quit, the ledge was just widening and it is on this account that they are sinking deeper. The average value of the ore is $28, I was told by Lancelle, one of the original owners. Ore yielding $28 ought to pay now.

Having completed my visit here, I left for San Andreas. All along the road are old hydraulic pits, exhausted or stopped by the Anti-Debris Act. Further on the right is Central Hill towards which, it is said, all the quartz claims converge. In San Andreas I did not find the men for whom I had letters; this gave me a chance to visit the new cement plant, 1½ miles distant. Mr. Poor, the general manager, told me that the company spent $200,000 in prospecting with diamond drills to ascertain the nature of the limestone deposit, its depth and extension; that afterwards $2,000,000 were spent for the building of a railroad, cement plant, etc. The plant capacity is 3,000 bbl. a day, and the storage capacity 68,000 bbl.

The next day I went to the Sheep Ranch Mine which after changing hands several times was finally shut down because the ledge was too small although rich and a paradise for high-graders.

From Fricot City I went to Angels Camp, whose mines around have been shut down since the war. On my way I saw the Bolden hydraulic mine which was stopped by the Anti-Debris Act; the mine was working day and night, paying well, but so located that retaining dams will be too costly for mining the gravel left. Further down I arrived at Fourth Crossing and noticed two new mines in a state of development. There seems to be a revival of quartz mining in that region, as I was told that in many places small crews of men are trying to develop ledges, but that lack of funds is the principal obstacle.

The same afternoon I went to Vallecito and visited the Western mine. It is a drift mine opening a section of the channel running through the Bishop's Estate, 2 mi. wide and 8 mi. long. They are developing the mine now and it is fully equipped with rotary mill, air compressor, pump, reservoir; 50 hp. is necessary for all operations.

Continuing my journey I visited the old diggings of El Dorado, Douglas Flat and Murphy. This little town is a jewel. All the streets are bordered by shade trees and green lawns around the houses create an atmosphere of cleanness unknown in most mining towns.

Columbia was my next stop, and I was much impressed by the magnitude of the diggings between the immense limestone boulders. A record of $55,000,000 shows that Columbia claiming at that time a population of 40,000 inhabitants (the surrounding towns included) had hoped to become the capital of the State. There it was that the first regiment of California was mustered out and one can still see the old barracks on the hill.

I noticed the old Catholic Church erected on the ground bought for mining purposes by Crawford of La Grange fame. It all reverted to the archbishop, as the ground had already been drifted.

From Columbia I went to Sonora, saw on my way the Chapparal mine on the Mother Lode, the Carson Hill mine where the most beautiful specimen of gold was found. Three hundred Mexicans are working in Carson Hill mine; on the Stanislaus River side a new plant for the treatment of the ores has been erected. From there a very picturesque road follows the old Bret Harte and Mark Twain trail, passing Tuttletown, made notorious by the many hold-ups during the period of early mining.

Arriving at Sonora I called on the Secretary of the bank, but found that he was out of town. His brother asked a mining man living near Jamestown to talk with me. He and I had an interesting talk on the mining situation and he said that lack of capital prevented development of the mines.

The next morning I went to see the Springfield tunnel and development mine not far from Columbia. This mine is the most important of all the drift mines;

opened up seventeen years ago it is not in production yet, most of the money available having been spent so far to sink shafts, drive tunnels and drifts, erect plants, pump water and finally run a tunnel lower than the lowest drift to drain the water in the mine, as none of the pumping experiments was successful enough to handle the 200 miner's inches found. This tunnel, over one mile long, absorbed most of the resources of the company and it is looking now for additional capital to proceed and reach the channels converging all in one place. The system consists of four channels; the Berry, the Fox, the Buchanan and the Mountain Channel. The gravel is so soft and free from boulders that the superintendent expects to raise it by using a gravel pump, after driving it by underground hydraulicking into the sump.

From this mine I proceeded to the marble quarries of Columbia. These are worked with the most modern methods. The only drawback for development on a larger scale at present is transportation, which is responsible for a large part of the cost.

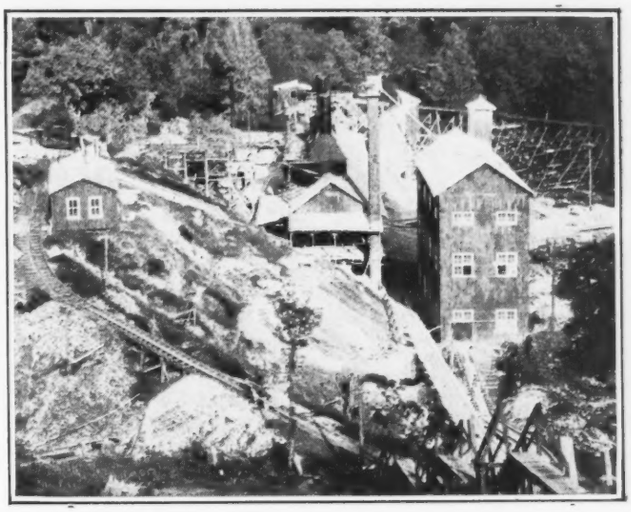
From there I went back to Sonora and then to Jamestown; all the mines I saw on the Mother Lode were lying idle, such as Harward, Crystalline, Alabama, and Rawhide. A jitney hired at Jamestown brought me the same afternoon to Lagrange on the Stanislaus River.

After supper I went to see the Lagrange dam about 2 miles up the river, and climbed to the ditches which distribute the water for the Modesto and Turlock irrigation districts. On my return I called on the superintendent of the dredge below Lagrange. We drove there; until midnight I watched the operations. This new dredge, built four years ago to replace the old one, is working under favorable conditions; the gravel is good, bedrock soft, depth 25 ft. and no boulders to hinder the operations.

Early the next morning I visited the old hydraulic pits and judging from the area worked out it is evident that the operations at Lagrange were carried on a large scale, with good gravel, enough dump and plenty of water. There is a lot of gravel left yet, but I do not think it will be possible to hydraulic it again as there is no area for a retaining reservoir.

This marked the end of my investigation. My conclusions are that at some future time most of the idle mines, placers and quartz, will be opened up again.

An old mine looks distressing, and it is distressing if, through ignorance, inadequate facilities, litigation or other untoward circumstances, it has to be abandoned, and to abandon it is a heart-breaking experience to most of men. But a good mine properly equipped, carefully managed and with a goodly store of auriferous gravel, or quartz developed, is about as comfortable an operating business as one can be engaged in. The product is worth as much when it is won at the mine as it is in London. It practically pays no transportation charges. Its value is fixed the world around, and no intelligent person questions it. Moreover, one has only to study the exhaustive reports of the representatives of the U. S. Geological Survey and of the California Mining Bureau to realize the wasteful processes by which gold was recovered in early days on the Mother Lode. The "diggings" were rich—they had to be to "pay" the way they were worked. This, too, accounts for the ridiculous size of the claims established in some districts. Think of claims 16 by 16 ft., or 20 by 20 ft. Consolidations have taken place during the last forty years. More will be made, more will have to be made, to embrace a sufficient area to justify the modern installations needed for best results. The gravels obtainable contain values running as high as 25 to 30c. per cubic yard for hydraulicking and from $4 to $6 for drifting. When you consider the profitable and satisfactory record of the Lagrange mine, operated as a hydraulic property under my direction, and yielding only 5c. a yard, you will agree that there is a justifiable basis for a fresh endeavor to bring about a restoration of mining activities along the Mother Lode, from Placer County through Eldorado, Amador, Calaveras and Tuolumne, along scientific lines, under capable management, and adequately financed by courageous forward-looking men, who will not be satisfied with less than the best possible results. Not every mine now idle will pay. But many of them can be made to pay handsomely if properly operated, and most of them will be.



Lime-burning plant near Sonora

Mining in the Belgian Congo

The extent to which the mining industry has been developed in the Belgian Congo is not generally realized. The only province important for its minerals at present is the Katanga, which lies in the southwestern corner of the Congo. The Katanga, according to the U. S. Department of Commerce, claims first place among countries producing cobalt and radium, third place as regards copper and diamonds, and will before long be an important producer of tin and gold. The following table gives the copper production of the Union Miniere du Haut Katanga since 1911:

	Metric Tons		Metric Tons
1911	997	1919	23,019
1912	2,492	1920	18,924
1913	7,408	1921	30,464
1914	10,722	1922	43,362
1915	14,054	1923	57,889
1916	22,149	1924	85,580
1917	27,462	1925	90,020
1918	20,237		

In 1925 the ore raised exceeded two million tons. The work that is being carried on at present includes the erection of reverberatory furnaces with a capacity of 30,000 to 40,000 tons of copper per annum and an increase of 30,000 kilowatts in the power station.

Useful Operating Ideas

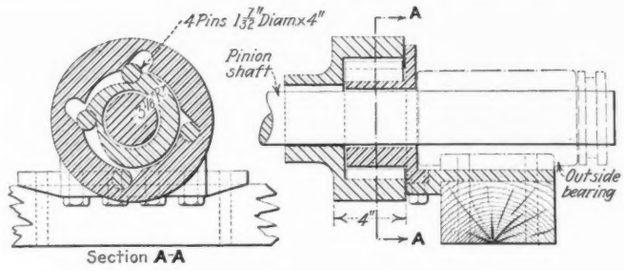
Reclaiming a Stockpile by Chinaman Chutes

By W. W. Raymond
Arizpe, Sonora, Mexico

A modification of the Chinaman chute was used at a mine in Arizona in reclaiming a stockpile and loading it into railroad cars. As is often the case, the shaft was located on a hillside higher than the loading siding. Along the railway siding an excavation was made with its floor 10 ft. above the height of an ore gondola and extended back from the track about 60 ft., where a dry retaining wall was built up to the level of the shaft collar, which was about 30 ft. above the cut floor.

Three trenches, 8 ft. wide and 11 ft. deep, as shown in the accompanying figure, were dug in the floor of the cut at right angles to the siding and 30 ft. center to center. Drift sets were erected in the trenches and lagged on the sides and top, leaving 18-in. spaces between the lagging over the center of the caps, and 2x8-in. plank, 2 ft. long, was placed bridging this opening, cleats 17 in. outside to outside being nailed on the planks to engage the lagging. The space between the lagging and the sides of the trench was filled and the spoil from the trenches was trimmed and tamped to form a ridge between trenches with sides sloping 30 deg. Trestles were erected over the center of the ridges to carry the tracks from the shaft.

The stockpile was accumulated by dumping mine cars from the trestles. When a shipment was made the gondola was spotted with its down-grade end opposite one of the drifts and a length of track, which bridged the gondola from side to side, was connected with the track under the Chinaman chute. A mine car was spotted under the front toe of the stockpile and the chute was operated by prying out the outside 2-ft. plank. A forty-ton car could be loaded in eight hours by one man with another to trim and help move the gondola.

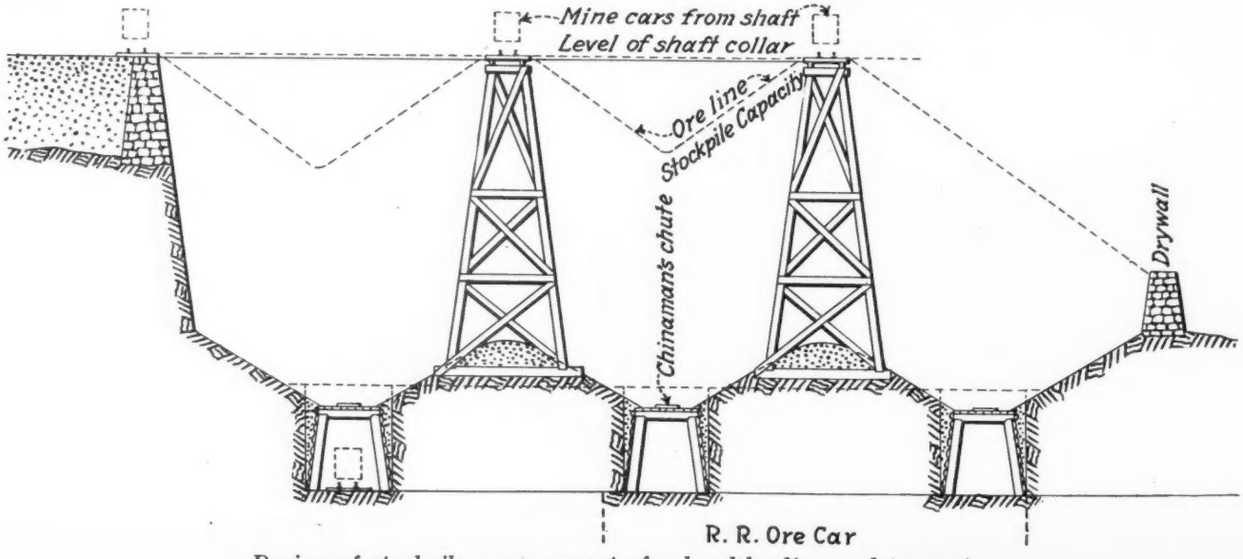


Suggested design of conveyor-locking device for use on inclined conveyors

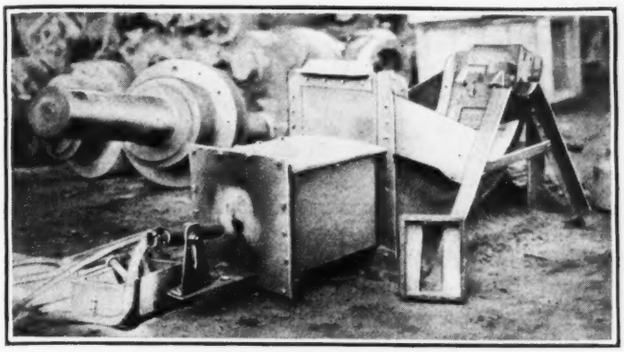
Lock for Inclined Conveyors

A novel type of conveyor lock designed by the engineering staff of the Utah Copper Co. for use upon inclined belt conveyors is shown in the accompanying illustration. The lock is mounted upon the pinion shaft close to the outside bearing. The outer revolving cup is keyed to the pinion shaft and rotates with it as shown in section *A-A*. On the inner surface are four depressions which contain four cylindrical pins. As each pin is carried over the stationary sleeve the pin drops into a curved run which returns the pin to its compartment. A second curved runway is placed in the lower left quadrant of section *A-A*. The pin falls into this and is again returned to its compartment. When the pinion shaft is stopped it is prevented from reversing its direction of rotation by the pins catching against the shoulders of the curved runs on the stationary sleeve. The device was planned for belt-driven conveyor units, but was never actually applied.

Whether it would stand severe operating conditions or would function satisfactorily is an open question. It is here presented as an illustration of an ingenious suggestion only.



Design of stockpile arrangements for hand loading and tramming

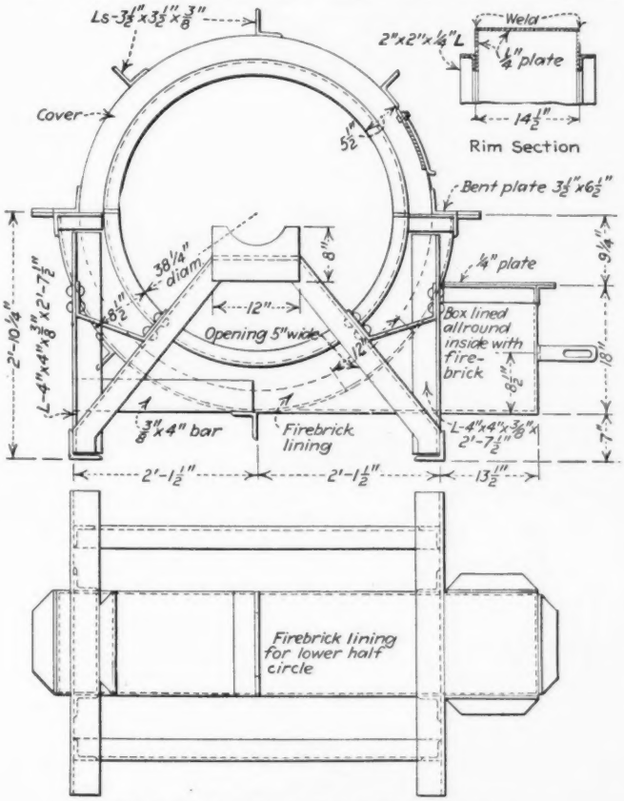


Lower half of furnace for heating roll shells, with burner in place

Roll Shell Heating Device

At the Garfield mills of the Utah Copper Co. worn roll shells are stripped by cutting with an oxy-acetylene torch. New shells are placed upon the rolls and are heated in a special oil-fired furnace which receives its oil supply from a portable pressure tank, compressed air being used for the operation of the burner.

The furnace which was first used at the Alaska

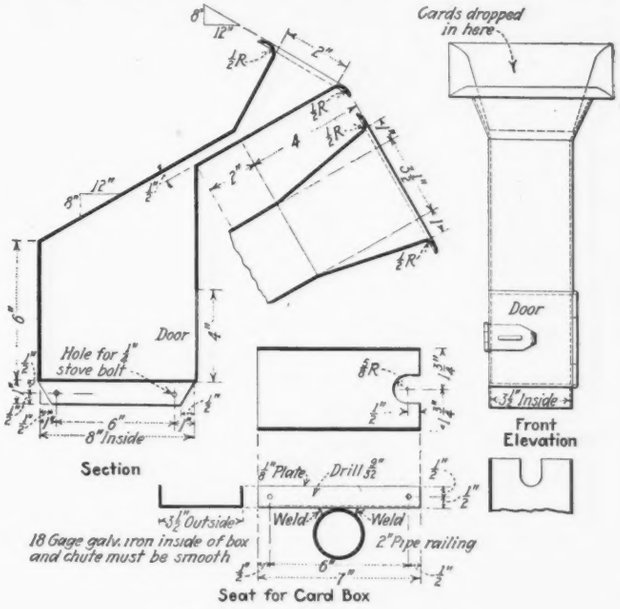


Sketch of roll shell heating furnace

Gastineau mill was introduced into the Arthur plant by Roy Hatch, the present superintendent. It is in two parts. The lower part contains the burner and combustion chamber and the upper part is removable. The lower part is provided with angle-iron frames to support the projecting ends of the shaft, and is lined with firebrick. In operation, the roll is picked up in a sling and placed in the lower part of the furnace. The burner is started and the cover placed in position. More than half an hour is required to heat the shell when the top part of the furnace is removed by the crane and the roll lifted out and set on floor jacks, the follower plates of the roll being set in position by a battering ram when they are bolted up. About an hour or less is required to set a new roll shell in place. The accompanying illustration shows the design of the furnace.

Time-Card Receiving Box

The accompanying illustration shows a time-card receiving box in use at the timekeeper's offices of the Garfield plants of the Utah Copper Co. A number of these boxes are installed on the hand railing near the time clocks in the various offices. As the men go off

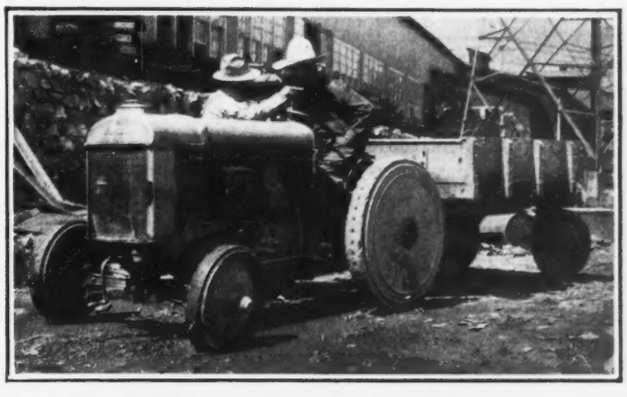


Time-card receiving box

shift they punch their cards and slip them into the receiving boxes. The cards slide into the box and are automatically stacked ready for the timekeeper.

Handy Truck for Salvage Work

At the Magna mill of the Utah Copper Co. a handy truck is in use by the salvage department. The truck body is mounted upon two rear wheels, each of which is mounted in a fork swiveled on the car body. Each wheel is in effect like a "caster" in that the vertical plane of the wheel is free to assume any position about a vertical axis. The front end of the car body is carried upon a tractor of well-known make. The accompanying illustration shows the rig, which is easily handled in working in the yards and about stockpile.



Handy truck for salvage yard work

Discussion

Rocking the Copper Boat

THE EDITOR:

Sir—My attention has been called to the editorial "Rocking the Copper Boat" that appeared in your issue of July 24. In that editorial you designate an analytical study of the copper situation captioned "Copper Industry Faces Shortage" that appeared in *The Wall Street Journal* of July 12, and which is well known in the trade to have been written by me, as sensational and exaggerated.

In that article written Saturday evening, July 10, I said that the statistical and technical situation was such that the price of copper would go up sharply. When I wrote that article, the price of copper was 14c. a pound delivered Connecticut Valley points. The day the article appeared, Monday, July 12, and practically simultaneously with its appearance, the price of copper advanced to 14⅛c. Within three weeks the price was 14½c., an advance of ⅜ to ½ cents a pound, whichever way you care to view it, and whoever bought copper on the advice given in that article saved himself in less than three weeks ⅜c. a pound on what he bought.

Before the June copper statistics appeared, I stated in that article that domestic shipments for the first six months had established a new record, which proved to be true. Before July 1 refined stocks were known, I estimated them roughly at 130,000,000 lb., which was within 3,000,000 lb. of what they proved to be. I stated that it was impossible for refineries to deliver in July all the copper the sales agencies had contracted to deliver, and that also proved to be true. I stated that this also would probably be found true of August, and I have reason for believing that it will.

I advised fabricators to face the situation like men, and not to try any longer to jockey for cheap copper. I made clear my reasons for giving such advice: (1) Because in an advancing market the buyer who anticipates his requirements the closest, and places his orders the earliest, gets his copper at the lowest average price; (2) because only by showing producers as closely as possible, and as early as possible, what the real requirements of the industry are to be in the next few months, and by displaying a willingness to pay a fair price for copper, can producers be encouraged to produce a larger tonnage than they are now—a highly important matter in case my belief proves well founded that second-half world consumption is to be so large as to make an increase in production desirable. Furthermore, even if my surmise be unfounded, it is to the advantage of all concerned to have stocks of refined copper larger and more evenly distributed between producer and consumer than now, and any advice that would tend to result in such a distribution would not be disadvantageous to the industry, especially if the consumer built up his stocks with copper costing less than 15c.

To assume that there was grave danger that my article would stampede purchasing agents into overbuying was highly complimentary to the influence of *The Wall Street Journal*, but to me it seems to show a lamentable lack of common sense and balance in the writer of your editorial.

In my article which you saw fit to impugn as to motive, I predicted that if domestic consumers did not act quickly, foreign buyers would beat them to the cheap copper. I believe that I am justified in estimating that in the last few weeks, and since my article appeared, Japan and Russia have bought in this market between 25,000,000 and 30,000,000 lb. of copper at a price nearer the equivalent of 14c. delivered than 14½c.

A final prediction in my "sensational" article was that a rather quick run-up in the price of copper would not be surprising sometime this fall—one somewhat similar to the one about a year ago when the price advanced almost a cent in a month. Despite an advance of ½c. a pound since the article appeared, I think that this prediction also will be borne out by developments.

You attempt to belittle my article by saying that "any difficulty in supplying consumers with needed copper can, in any event, be only temporary." I should think that the editor of the *Engineering & Mining Journal* would know, as result of the examination of the copper sales books of so many agencies as he claims to see in determining the price of copper, that at present and at the time the article was written, copper was being bought only one month, two months, and rarely even three months, ahead of requirements.

Surely, if anything is to be written of value as to the trend of copper prices it must, with conditions as chaotic as they are at present in Europe, deal mainly with the price trend over a period of only a few months in advance, and at present, in the main, it is the more immediate conditions which are to prevail that influence the price of the metal. Whether or not the condition that I foresaw must result in a run-up in price should prove "temporary" or more permanent, surely it was a perfectly legitimate part of my work as a writer on metal markets to try to predict the trend of copper price during the next few months.

My conception of price trend when I wrote the article, and it has been indicated consistently in *The Wall Street Journal* metal column, was a price of 15 to 15½c. a pound for copper by the end of the first week in October. So far as I can see there is nothing in that article to suggest that I myself looked for anything other than some such run-up. Why any such price level as I was discussing must "inevitably be followed by a painful reaction" as you imply in your comment on my article I fail to see.

In 1909 and 1910 in my magazine *Mines and Methods* I believe that I was the only one who tried to protect the copper industry from the inevitable consequences of the false statements which were being made by the porphyry companies in getting funds for the over-equipment of those mines. I tried to make the copper industry realize that if the so-called porphyry mines were permitted by false propaganda to over-equip themselves, as they were striving to do, copper production must inevitably be increased much faster than consumption could possibly

expand; that once those mines were over-equipped, they must be run at a high rate so as to keep the capital investment earning through being worn out instead of rusting out, and in order to get some semblance to the costs they were claiming as realizable (but which they never attained); that if the industry did not wake up, and prevent this over-equipment, the price of copper must inevitably for the next ten years be placed in the hands of the consumer as result of the perennial actual or potential over-production that would follow. Take the five years of the war out, splice the tape of time together, and you will find that this prediction unfortunately came only too true.

In closing, I predict that, unless the copper industry soon begins to show up the facts as to the true cost of producing copper, and how much greater the costs actually are when interest is properly figured than the "costs" appearing in company reports, and unless the industry goes to the trouble of showing what are going to be the actual costs of producing copper in South and Central Africa with interest properly figured, so as to discourage over-equipment of these newer deposits, the copper industry will be facing another period of over-production just as it is about to emerge from the consequences of the porphyry over-equipment.

New York. CLAUDE T. RICE.

We find nothing in the foregoing letter to alter the opinion expressed in the editorial. The caption "Copper Industry Faces a Shortage" appearing over a story a column and a half long, in itself is sensational, exaggerated, and misleading. In the last two paragraphs of Mr. Rice's letter he describes the condition that exists today—namely, the market is in the hands of the consumer as the result of "potential" overproduction. This possible overproduction is in a large measure the consequence of the remarkable improvement in concentration by flotation and the active era of plant construction that followed the war.

The editorial explicitly stated that there was for the moment a shortage of actual refined copper of desired shapes. This was caused principally by furnace difficulties at two of the refineries. In the face of this situation Mr. Rice argued that "fabricators should begin at once to contract for their requirements as far ahead as they can see them." The editorial, "Rocking the Copper Boat," contended (and this is the essential point at issue) that this counsel was bad. It advised producers as well as consumers to keep cool. We are convinced that this advice was sound even if the purely selfish interests of the copper producers alone are considered.

Had any considerable number of important buyers followed the advice in *The Wall Street Journal*, and had sellers let the market take its course, it is likely that the price would have risen to say 16 or 17c. In a few weeks buyers would have contracted for their requirements for six months, and with virtually no buying afterward, the market, conceivably, would have dropped quickly several cents. Something like this, though on a small scale and with price changes within narrow limits, has happened a dozen times during the last few years.

The editorial suggested that "consumers who have been buying from hand to mouth could profit from the lesson of the existing condition by covering their requirements farther ahead."

We did not purpose to impugn any one's motive. It was pointed out that in the past a consequence of fluctuations in the price of copper has been a corresponding fluctuation in the stock market. No one will deny that professional Wall Street profits by wide and rapid movement in share prices.

In behalf of the purchasing agents for the fabricators, one may say that they can hardly be blamed for "jockeying" for cheap copper. That is the job for which they are employed; any clerk could place orders for copper. We did not think that there was grave danger of buyers being stampeded by Mr. Rice's article into "over-buying" or even into "contracting for their requirements as far ahead as they can see them." But the fact that advice is not taken does not make it less bad.

The *Engineering and Mining Journal* would like to see copper at the highest price that it can command without strangling consumption. Decreased consumption ultimately means curtailed production. Just what the "right" price level will be no one can say, but equilibrium will be reached when the world rate of consumption approximates what may be called the "equipped productive capacity." In the meantime any price advance that is justified by fundamental conditions will come about in the natural course of events.—EDITOR.

Agitation Against California Blue-Sky Law

THE EDITOR:

Sir—Will you grant me space to comment upon your editorial, "Agitation Against California Blue-Sky Law," which appeared in the issue of August 21? It is a subject seriously affecting the mining industry in this state and I feel that you have closed your ears to the other and more important side of a question that is becoming increasingly important, not only to the mining industry, but to every other line of initial endeavor.

Your argument that the granting of twenty-seven permits by the Corporation Department during the months of May and June proves that California is a good state for marketing stocks; that money is plentiful; that buyers are not particularly exacting; that the department is tolerant and does not apply especially restringent requirements, is wholly illogical and known to be so by any man who has had business with the department. It is also generally known that at least three-quarters of all the corporations organized with California capital, are seeking incorporation in other states where laws are more liberal—for instance, Nevada and Delaware. The Supreme Court of this state has already ruled that the department cannot interfere with the sale of personal securities, so that the result of the oppressive rule of the department is that California is losing not only supervision of a vast majority of new companies, and therefore possibly some securities of fraudulent tinge, but is also losing the fees that go with incorporation, expenditures incident to the maintenance of state offices, and, above all, has earned the name of being a poor state for the prudent business man to operate in.

Your analysis of the eventual destination of the amounts involved in the permits granted by the department in the period selected by you is obviously based upon premises that border upon the absurd. There is no assurance that any part of the nominal capitalization will be raised, neither is there any way of ascertaining at what discount from par such stock would be placed, if at all. I will therefore pass over that part of your editorial, as not serious enough for discussion.

What I would like to impress upon you is that the agitation against this law is widespread and that it is

based upon the fundamental objection that constitutional rights of the individual have been set aside. Instead of government by law, we now have in California government by permission; in other words, government by men. No one can tell when this law has been complied with. The rules are changed at the whim and caprice of one man and in this case a man absolutely without knowledge of mining and who is well known to be out of sympathy, not only with it, but with men engaged in honest effort to develop our great dormant mineral wealth.

As one who is trying to develop a property of merit and is raising capital by the sale of stock, I strongly object to your sneering attitude towards "stock-sellers." If, instead of decrying this method of raising capital, you would devote a column now and then pointing out methods you consider better and more efficacious, you would help the mining industry of the West, instead of casting unnecessary reflections upon it.

The Mineral Industry League to which you refer has made great headway and is guided by men in whom the members have the utmost confidence. Its membership is growing rapidly and is by no means confined to "stock sellers." As a matter of fact, some of its heaviest backers are bankers and business men of high standing, who believe that the law, especially as administered by the present Corporation Commissioner, is destructive of the initiative which is so essential to the development of a country like this.

Have you studied the laws governing promotional effort in other mining states, such as Idaho, Montana, New Mexico and Colorado? If you have, will you advise us through your columns why you think California should retain a law that has resulted in serious decrease in metal production and is anathematized by a very large part of the population of the state?

It will interest you to know that a meeting is to be held at Sacramento this month under the auspices of the department of mines and mining of the Sacramento Chamber of Commerce and California chapters of the American Mining Congress, to which have been invited representatives of every important organization in the western states, including the Mineral Industry League of California. The fourth subject set forth on the program is as follows: "Discussion of a revision of the California Corporate Securities Act, so as to require all industrial concerns, where stock is to be, is being, or has been, sold, to file with the Secretary of State's office a public sworn statement of operations, showing expenditures, income and output, every three months, as the most effective way of protecting the investing public. Also, that all mineral enterprises be submitted to the State Mining Department."

I call your attention to the fact that such provisions would closely parallel those of the Colorado Securities Act, which is recommended by the Mineral Industry League in conjunction with a provision to refer all promotional efforts based upon mineral resources to the Department of Mining, so that they would be in the hands of a sympathetic and well posted agency. That looks as if the other organizations of the state had at last heeded the agitation stirred up by the Mineral Industry League and had also decided that there is merit in its contentions.

Finally, let me call your attention to the political situation in this state, as shown by the primary election of day before yesterday. Governor Richardson has been defeated for the Republican nomination. It is well to remember that he is the only candidate out of six running for the nomination who refused to express an opinion upon the Corporate Securities Act and that he and he alone is responsible for the present Corporation Commissioner, who, in the opinion of a very large number of people, has wrought more harm to business in this state than any other man who ever held office. On the other hand, every other candidate definitely opposed the act or its administration, in response to a letter put out by the Mineral Industry League. Lieut.-Governor Young, who has been nominated, has admitted in writing that administration of the law under the present auspices has brought great harm to the state and he is definitely committed to removal of the present commissioner. The third candidate, Judge Goodcell, opposed not only the principle involved in the law, but also its administration and has drawn a splendid vote considering the great obstacles encountered in his campaign.

The misinformation woven into your editorial must have originated very close to the Corporation Commissioner himself. None other could have had the hardihood to present it to you as fact. As a reader of your journal for many years, I deplore the attitude you have assumed towards the man of small means endeavoring to raise mining capital. I assure you that you have no monopoly upon desire to protect the investing public. Every decent man wishes to minimize dishonesty, but some of us contend that good old American criminal laws will attend to that if they are energetically applied and that, when they are, the honest man will regain his right to go about his business without the impertinent and destructive influence of one man placed above all law to do as he sees fit and change the rules of his game at will.

To close, you may have noticed that Corporation Commissioner, E. M. Daugherty, who has caused all this agitation, resigned the day following the primary election. And that's that! F. ALBERT MORRISON.

Los Angeles, Calif.

"Blasting in Massive Sulphide Ores"

THE EDITOR:

Sir—Your article under the heading "Blasting the Massive Sulphide Ores" in the issue of May 22 last makes no mention of any discrimination in the use of different types of explosives which may produce high or low temperatures in this connection. In mining the Mount Lyell mine orebody by underground methods the employment of high-temperature ignition explosives, such as 60 per cent gelignite, was found to be highly objectionable on account of the large volume of sulphur dioxide and appreciable quantity of hydrogen sulphide produced, which necessitated the evacuation of the mine after firing operations until the ventilation currents had diluted those gases sufficiently for work to be resumed. This unsatisfactory condition led to the adoption of low-temperature ignition explosives consisting of ammonium nitrate compounds, such as Monobel, and the exclusive use of these prevented the formation of gases mentioned. To obtain the necessary detonating force a small primer of gelignite was used but the amount was strictly limited, and primers were made up only by magazine attendants. This practice was put into full operation in 1912 and has obtained ever since without any objection following its adoption.

The Mount Lyell mine ore is a hard massive sulphide having the following average assay: S, 46; Fe, 39; SiO_2, 6; BaO, 2; Al_2O_3, 3; Zn, 2; Pb, 1.5; Cu, 0.5; Ag, 1.5 oz.; and Au, .04 oz. G. FRED JAKINS.

Gormanston, Tasmania.

News of the Week

The Mining News given in ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

AUSTRALIAN gold producers want government aid; gold exports to United States approximate £5,000,000 in few months.

British Columbia mines operating at full capacity; much development work under way—Chilean nitrate industry depressed.

Lepidolite deposits near Leavenworth, Washington—New Jersey Zinc options property in Chloride district, Arizona.

Beaver Consolidated, Cobalt, Ontario, developing Elk Lake property; stockholders at variance with directorate.

"Cleaner" financing of mining properties the vogue on the Rand—Russian potash deposits reported large.

Humboldt sulphur starts plant producing 30 tons per day—Simon flotation plant, Mina, Nevada, resumes—Tonopah Belmont to enlarge mill—Hawthorne suffers water shortage.

Premier Paymaster to increase shaft capacity—Yukon mines ship to Kellogg smelter—Quebec allows additional time for assessment work.

Steps taken to improve platinum recovery in South Africa—Transvaal gold production increases—Boksburg Gap disappointing.

China grants antimony concessions to Germany—Almaden quicksilver mines have large reserves, after 2,000 years' operation.

Four new mills for Joplin-Miami district.

Federal Common Stock Dividend Case to Be Decided About October 15

Suit between Federal Mining & Smelting Co. and three preferred shareholders trading as H. Content & Co. came up to the Delaware Supreme Court Sept. 9, upon appeal by the Federal company from decision of Chancellor J. O. Wolcott of the Court of Chancery at Wilmington, who on May 12 overruled the company's demurrer to the injunction proceedings brought by Content & Co. to enjoin payment of dividends upon the common stock so long as a capital deficit was shown by the company's books. Chancellor Wolcott at the same time issued a temporary injunction. Decision is expected to be made on Oct. 15.

The suit was filed Jan. 9 as a test case to determine rights of common and preferred shareholders under the charter and by-laws of the company and the laws of Delaware as result of declaration by the board of a dividend of $10 a share upon the common stock and accumulated back dividends upon the preferred stocks and the adoption by the board of a resolution declaring the intention of the company in the future to pay out as dividends upon the common stock approximately half of current operating earnings, with the remainder reserved for acquisition of new properties and other corporate purposes.

Aerial Survey of Alaska a Success

The Department of the Interior announces that this season's aerial photographic mapping program being carried on in Alaska by the Navy Department in co-operation with the U. S. Geological survey is nearing successful completion.

Burma Restores Railway Communication

Railway communication has been restored by the Burma Corporation between the treatment plants at Namtu and the mine ore bins at the Tiger tunnel entrance, but has not been restored (Aug. 30) between the latter point and the mine headquarters at Bawdwin, owing to heavy landslides caused by continuous rainfall. One of these landslides from the precipitous hills surrounding Tiger camp buried several barracks and caused the death of 43 native employees. Several hundred men are at work clearing the fall and effecting necessary protective work on the hill sides. Work at the mine and treatment plants is proceeding normally.

Railway Extension in Rouyn District

The Canadian National Railways is grading a line westward, from its O'Brien Rouyn branch, in Quebec, to serve the Amulet and the Waite-Montgomery mines and diagonally to reach the rich Alderson-Mackay, Nipissing and Conigas groups in Boischatel and adjoining townships. This will put the Canadian National Railway materially ahead of the Timiskaming and Northern Ontario, if the latter ultimately goes into Quebec province. Meanwhile, it is understood the T. and N.O. has taken up with the Quebec Government the question of turning the surveyed line of their delayed road into a wagon road.

Smelter Costs at the Noranda Estimated at Five Dollars Per Ton

An official preliminary estimate of the cost of smelting copper ore at the Noranda smelter is that it will not exceed $5 per ton. On this basis, estimates of the cost of ore from the mines in the adjacent field have been worked out. While costs of mining and smelting ore from the Noranda mine itself will amount to $7 or $8 per ton, at the most, it is evident that total costs for such mines as the Waite-Montgomery and the Amulet will amount to about $10 per ton. The added cost would be required to cover transportation, as well as a moderate margin of profit for the Noranda smelter.

Catlin Shale Plant to Make Test Run

The Elko, Nevada, plant of the Catlin Shale Co. is to be the scene of a test early in October. The plant was visited recently by R. M. Catlin, founder of the Catlin Shale Co., who has pioneered in the industry ever since he was a superintendent of mines at Tuscarora forty years ago. Others in the party were David A. Shepard, president of the Columbia Oil Shale Co. of Colorado; John Goodale, consulting engineer; Conaher and Brown, consulting engineers of Scotland. Mr. Conaher is also managing director of the Scottish Shale, Ltd.

The forthcoming test is to be made for the purpose of determining whether the Catlin process could be used by the Columbia Shale Oil Co., which is financed to build an 18,000-ton plant at Glenwood Springs, Colo.

Humboldt Sulphur Co. Installs Plant

A sulphur recovery plant was recently completed by the Humboldt Sulphur Co. of Sulphur, Nev., 60 miles west of Winnemucca. Initial operations were delayed by a retort cover blowing off which resulted fatally to two employees. After a delay of ten days, operations were resumed.

Sulphur is first concentrated by treating the sulphur-bearing rock in a retort with steam and hot water. The resulting fluid mixture of water and sulphur is drawn off to a digester and the sulphur separated by a Nordon filter. The product is sulphur of exceptional purity which finds a ready market locally in Nevada, Utah and Idaho. It is especially suitable for sugar refineries. Present production is about 30 tons per day. An 80-hp. oil-fired boiler supplies steam for the retort. Power is provided by Diesel and gasoline engines. It is intended to enlarge the plant. The deposit which is now supplying the crude sulphur rock is 1200 acres in extent. The thickness varies, ranging from 10 to 50 ft. A. J. Crowley is superintendent and general manager, and H. L. Hazen metallurgical engineer.

Four Mines Operating in Katherine District

In the Katherine district, Mojave County, Ariz., four new development companies are now operating. The Katherine mine is reported to have struck 15 ft. of high-grade gold ore on the 300-ft. level, the new strike being about 200 ft. east of where entry was made into the large ore shoot on the 200-ft. level. This strike adds materially to the ore reserves of the mine and has increased interest in the district. The Comstock Silver Mining Co., operating at Stockton Hill, 11 miles north of Kingman, has drifted 40 ft. along the Banner vein on the 250-ft. level, the drifts having been driven each way from where the vein was cut by the crosscut. Both faces are reported to be entirely in ore. Oatman has attracted the keenest interest since the opening of the Big Jim and United Eastern mines. The Western Apex orebody on the 700-ft. level is reported to be 30 ft. wide in the east drift.

Simon Silver Resumes Operations at Flotation Plant

Milling was resumed at the 200-ton flotation plant of the Simon Silver-Lead Mines Co., at Simon, 22 miles from Mina, Nev., late in August. The mill has been idle for a long period due to lack of sufficient tonnage in the mine to insure continuous operation. Mine development was continued with satisfactory results. The main shaft has been sunk to the 800 level and at this elevation crosscutting has disclosed the downward continuation of important ore bodies developed above. The ore is a low-grade silver-lead-zinc combination and two concentrates are made; one a lead-silver, and one a zinc-silver. These concentrates are hauled to the railroad, a distance of 22 miles, and shipped to Utah and California smelters.

Premier Paymaster mill, South Porcupine, Ontario

Premier Paymaster to Increase Production

The new mill on the Premier Paymaster, South Porcupine, Ontario, is operating satisfactorily, the ore being exceptionally easy to treat. Production varies from 350 to 400 tons a day, and relatively low costs are reported to prevail. The company is planning an increase in the shaft capacity, in order to enable the mill to operate to a maximum tonnage.

Tonopah Belmont to Enlarge Mill

The Tonopah Belmont Development Co. is to add another 50-ton unit to its recently completed 50-ton concentration plant, Hamilton, Nev. Mine developments in the so-called Nevada and Cornell mines have been so satisfactory that tonnage in sight has justified this additional equipment and expenditure. Construction will be rushed in order to have the new addition well under way before the arrival of winter weather. The ore is lead-silver with a little gold. The veins are not usually wide but contain extensive ore shoots of good grade.

Hawthorne Short of Water

The Hawthorne Mines, which owns a 200-ton flotation plant, Hawthorne, Nev., has been forced to discontinue milling operations due to shortage of water. Mine development is to be continued and as soon as water is available milling will be resumed.

Coeur d'Alene Wage Increase Follows Lead Advance

Wages of miners in the Coeur d'Alene district advanced 25c. per day on Sept. 1 by reason of the advance in the price of lead to $8.90 per hundred. Miners are now receiving $5.50 per day and muckers $5. This means an increase of approximately $1,250 per day in the wages of the district or $37,000 per month, and affects nearly 5,000 miners scattered through the mines and prospects of the district.

Manitoba Copper Property Sold

The Baker-Patten property, situated north of The Pas, in Northern Manitoba, containing a large body of sulphide copper ore, owned by H. J. Hacker, John Lee, and S. Hart Green, of Winnipeg, has been sold to J. J. Callahan and W. J. Grace of Toronto. The sale involves a preliminary payment of $300,000. The sum of $35,000 has been spent in proving up the property.

Hollinger Reduces Operating Costs

The Hollinger Consolidated, Porcupine, Ontario, has been reducing its operating costs to new low records, and a rate of about $4 a ton has now been established, and a further reduction to $3 a ton is in prospect within the next year or so. This has been accomplished by adopting a system of wide drifts, allowing three-foot track to be installed instead of the narrow track formerly used. The wide gage track of the miniature trains in use underground renders operations smoother. Ore-handling facilities have been increased by more than 200 per cent.

Yukon Mines Ship 3,000 Tons to Kellogg Smelter

Mining companies in the Mayo district of Yukon Territory delivered 3,000 tons of lead-silver ore to the Bunker Hill smelter at Kellogg, Idaho, in July and August and will deliver as much more before their shipments are concluded for the season. The chief contributor is the Treadwell-Yukon. The ore is sufficiently high-grade to permit long hauls by tractor over the snow, two water hauls and a rail haul.

Seneca Completes Construction Program

With the completion of the addition to its compressor plant at No. 2 shaft, Seneca, at Mohawk, Mich., will have completed its construction program so far as present needs are concerned. Sinking in No. 1 has been completed to the 9th level and stations are being cut at the 8th and 9th preliminary to crosscutting to the lode. No. 2 shaft is bottomed at the 17th and favorable ground is being opened, especially to the north. In No. 3, better rock than was expected is being mined. Stoping is proceeding on the 13th. The labor situation at Seneca is satisfactory. Houses at Ojibway are being used. About 300 men are on the payroll.

Sale of Arnold Property Pending

The Arnold property in Keweenaw County, Mich., the sale of which will be considered at a special meeting of the shareholders of the company at Boston Sept. 28, carries the underlay of the Osceola, Calumet amygdaloid, Calumet conglomerate and other well known lodes. The Arnold was worked only on fissures. No modern explorations have been carried out on the regular lodes in this area.

Calumet & Hecla Adds More Electric Locomotives

The Calumet & Hecla, Calumet, Mich., has added several new electric locomotives to the underground equipment in Nos. 13 and 14 shafts on the Osceola lode. A larger tonnage from these units now will be possible. No. 3 North Tamarack shaft, which will be reopened, is undergoing repairs in the central compartment, this work having reached the 24th level.

Plans Fourth Furnace

At the Calumet & Hecla Consolidated smelting plant at Hubbell, Mich., the furnace building has been extended to provide room for the ultimate construction of another large furnace. Three of these units have been built and will be ready within a few months to handle the entire present mineral product of the consolidated mines.

Phosphate Company Increases Production

Output of the Cokeville Phosphate Co., Cokeville, Wyo., has been increased to meet growing demand on the Pacific coast. This industry, which began in 1923 with the shipment of only three carloads, will ship 400 carloads this year. Plans are being made to increase production to 500 tons a week.

Enterprise Lead Mine to Be Opened

A group of Montreal capitalists has become interested in the old Enterprise lead mine, near Pearl, on the line of the Canadian National Railways, about 35 miles east of Port Arthur, Ont. This deposit was discovered in 1865, and shortly afterwards development was undertaken and a shaft put down to a depth of about 200 ft. It was operated for a short time, but was never a really important producer. A rich mineralized 4-ft. vein carrying galena, and chalcopyrite occurs in a pale red indurated marl. The gangue is quartz, calcite, and barite.

Rouyn Railway Half Completed

Construction work on the branch line of the Canadian National Railways to Rouyn, in Northern Quebec, is being speeded up. Twenty-three miles of steel have so far been laid, leaving 20 miles to be completed. With favorable weather during the fall, there is every prospect that the line will be completed not later than the end of November. Progress so far made has been greater than was anticipated when the work was commenced.

Iron Loss in Flue Dust Equals Three Per Cent of Iron Produced

Seventy-five thousand tons of iron is lost yearly in the Birmingham district in flue dust escaping from blast furnaces, states the Bureau of Mines, which has conducted a study of the subject. The flue dust losses will average 250 lb. per ton of pig iron produced. On the basis of the present rate of pig iron production the annual loss of flue dust exceeds 300,000 tons. The iron content of the dust probably averages 25 per cent, and the loss of iron from this cause thus amounts to about three per cent of the iron produced in the district.

Canada's Mineral Industry Advances

Continued progress in the first half of 1926 was shown by Canada's mining industries, and production reports from almost every field pointed to the establishment of new records during the present year, according to a statement issued from the Dominion Bureau of Statistics at Ottawa. Valued at $98,395,788 the output of metals and nonmetallic minerals including coal, gas and oil, marked an advance of $8,048,090 or 8.9 per cent over the totals reported for the first half of 1925, and a sum equal to 52 per cent of the output of such commodities during the entire calendar year 1925.

Quebec Allows Additional Time for Assessment Work

The Quebec Bureau of Mines has announced a change in rules as to work requirements which will prove highly beneficial to the prospectors in the field. December and April are added to the non-working months of the year, making five in all: December, January, February, March and April. Work on claims must be done within a period of six months from date of staking, but the above five months are not included. For instance, on claims staked on June 1 of this year work need not be filed until May 1, 1927. This act is retroactive to June 1, 1926.

Tonopah Belmont Makes Test Run

The new concentrating plant of the Tonopah Belmont at Hamilton, Nev., has made a test run during which results were highly satisfactory. After two days operation, the mill was shut down pending the making of minor adjustments on the tramway.

Tonopah-Canadian to Start Mill in September

The Tonopah-Canadian, Gowganda district, Ontario, is making good progress with the construction of its 100-ton mill, which is expected to be in operation early in September, when it will probably handle 75 tons per day.

Underground development on the Walsh claim has opened up an oreshoot which has a length of 430 ft.

At the 300 level of the Morrison claim some rich ore has been encountered. It is believed to be the apex of an important shoot.

McIntyre Porcupine Opens New Orebody

At the McIntyre Porcupine Mines, Schumacher, Ont., recent developments have disclosed rich ore in the lower workings at No. 11 shaft, carrying from $15 to $20 per ton. The occurrence of high-grade ore in this section indicates that McIntyre will be able to extend its developments for upwards of one mile in length along the ore zone.

Barry-Hollinger Mill Ready for Operation

The enlarged mill of the Barry-Hollinger Company, Boston Creek, Kirkland Lake field, Ontario, will be ready for operation soon. It has a daily capacity of 150 tons. The richness of the ore is increasing with depth.

Three entirely new veins ranging from two to five feet in width and containing high-grade ore have been encountered in the course of diamond drilling.

Silver-Lead Prospect Near Bishop Purchased

A silver-lead prospect known as the Reed Flat silver-lead mine, 21 miles east of Bishop, Calif., has been purchased by the Mexican Mining Co. of Virginia City, Nev.

Production at the Ophir silver-lead mine controlled by the Engineers Exploitation Co., has been increased to 50 tons per day, a depth of 500 ft. having been reached in development work.

Crown King Property Sold

The assets of the Crown King Consolidated Mining Co., Crown King, Ariz., formerly owned by the late Frank Murphy, were purchased recently at sheriff's sale by Mrs. Frank Murphy and the Murphy Estate. The mortgage was held by the Prescott Realty and Security Co. The sale was for $98,492 and returns the title in the property, free of all encumbrances, to the Murphy Estate.

Lepidolite Discovered Near Leavenworth, Washington

Vein Thirty Feet Wide Encountered in Trinity Tunnel While Driving for Copper Deposit

BY R. G. MACPHEE
Spokane, Wash.

THE production of lepidolite may soon become one of the non-metallic mining industries of Washington as a 30-ft. vein of this material was recently intersected by the Trinity tunnel of the Royal Development Co., Leavenworth, Wash., which has been operating since 1917 and has spent to date, about $600,000 in developing a deposit of copper-silver-gold ore in the Cascade range northwest of Leavenworth.

In upper tunnels, and by surface trenching, the company has proved an ore zone 267 ft. in width and extending in a north-south direction for more than a mile. The holdings of the company embrace 108 claims, covering all of the mineralized sections of that part of the Cascade range.

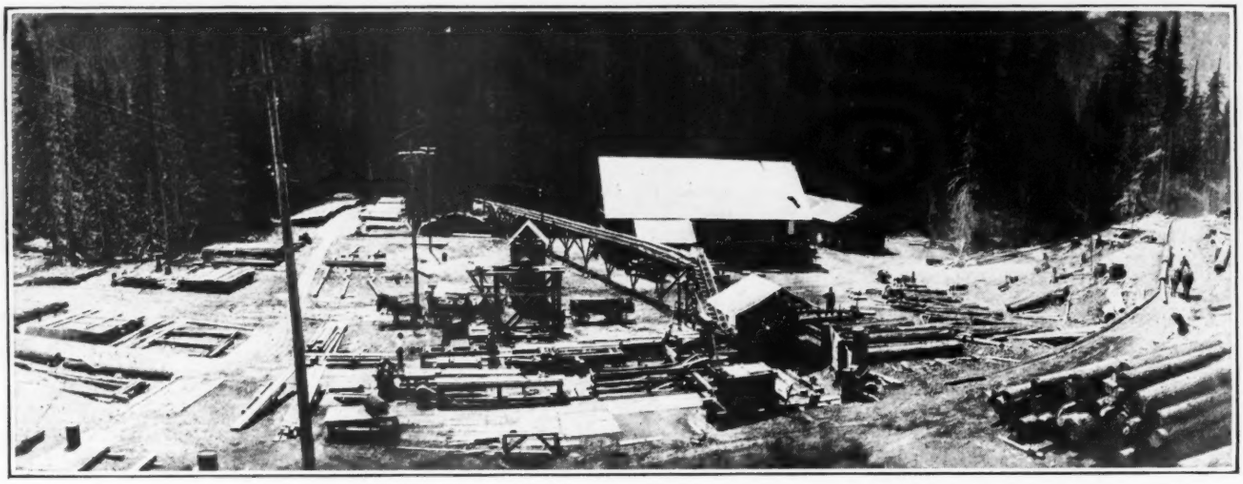
In 1922, to avoid snow conditions which made operations in the upper workings impossible six months of the year, a site was cleared for Trinity camp, and the driving of a two-mile tunnel was started. It will intersect the ore zone developed above at a depth of 1,800 ft., and be used as a haulage way. Thorough sampling indicates that the ore will average about 3½ per cent copper, 8 oz. in silver, and 40c. to the ton in gold.

At a point about a mile from the portal of Trinity tunnel the bore drove into a deposit of lepidolite 30 ft. wide. Lepidolite, also known as lithia-mica, is found only in a few districts of the United States: In the Black Hills of South Dakota, in California, and in New Mexico. It is used in the glass industry and in the manufacture of lithia products. The vein is almost vertical, and the deposit can be taken out by a caving system, as the wall rocks are of a hard gneiss. But little timbering will be required.

The Royal Development Co.'s wide ore zone has been intensely faulted and intruded extensively by aplite, granodiorite, andesite, and other granitic dikes. All of the rocks have been highly metamorphosed, so that the entire district presents a nice problem for the geologist. The northern end of the ore zone is in the Una basin, where there is an extinct volcano and an active glacier. All of the area has been subjected to intense glaciation. The Royal's ore zone occurs in a brecciated structure. The rocks exposed are granitic gneiss, schist, aplite, andesite, and breccia. Mineralization occurs in lenses of chalcopyrite and also in the form of a disseminated pyrrhotite. The silver accompanies the sulphides; the gold is found in the gangue material.

The assays also show insignificant values in lead and zinc. In the Una basin sector there is another parallel vein carrying silver and lead. Surface development has been done only on this vein, as it is the intention of the company to confine operations to the lower Trinity tunnel and develop the entire project from that point.

Across the divide, about 20 miles away, the Sunset Copper Co. is developing and shipping copper ore. At Blewett Pass, the old Blewett mine, which in the past has shipped high-grade gold ore, has been reopened, and an examination of the mine and tests of the low-grade ores are now being made with the view of installing a plant to handle the ores.



Sawmill, powerhouse, and lumber yard near portal of Trinity tunnel, Royal Development Co.

New Mills for Joplin-Miami Zinc District

The Acme Lead & Zinc Co., Tulsa, Okla., is completing a new mill in the Waco section of the Joplin-Miami field, replacing the one that has been in operation for several years. The original mill was not large enough. The property is owned principally by L. P. Buchanan, of Joplin, who also owns the Butte-Kansas, also at Waco. The two properties have been highly profitable.

The Kansas Explorations Co., Joplin, Mo., has started construction of a mill on the Ritz lease, near Cardin, Okla. The Kansas Explorations is a subsidiary of the St. Joseph Lead Co. The Ritz lease early in the year, was sold at public auction and brought $105,000. The sale only recently was finally approved at Washington. The approval was followed by immediate steps looking toward the construction of a mill.

Hulen, Bailey, and Emmons, Baxter Springs, Kan., and associates are contemplating the erection of a mill on the Morrison land, northwest of Baxter Springs.

The American Zinc, Lead & Smelting Co., Joplin, Mo., is drilling an 80-acre lease in the Waco field. The Golden Rod Mining & Smelting Co., Joplin, Mo., is drilling the Lenhardt tract in the same field.

The Huttig Lead & Zinc Co., Baxter Springs, Kan., has given a contract for a new mill on the Beck lease at the site of the old Mars mill. The company has done considerable drilling on this property with satisfactory results.

New Jersey Zinc Options Property in Chloride District

Reports in Kingman and Chloride, Ariz., are to the effect that the New Jersey Zinc Co. has secured options on the Pilgrim and Beebe properties, west of Chloride. The Desert Power & Water Co. has completed the power line to within two miles of these properties and a connection has been made with the main line. Full electrical equipment is said to have been ordered through Kingman machinery houses. Chloride has a number of deposits of zinc and lead ores. The Tennessee which is again shipping, is one of the oldest producers in the district, with a depth of approximately 1,600 ft. The Tennessee was closed down for many years owing to litigation, but under the management of the Arizona Lead Mines Co. promises to become exceedingly active. The Chloride Mining and Milling Co. has its new mill practically completed, and expects to treat 50 tons a day from the Tennessee in addition to its own ores.

Johannesburg Letter

By John Watson
Special Correspondent

Steps Taken to Improve Platinum Recovery—Gold Production Increases—Boksburg Gap Disappointing

Johannesburg, Aug. 10 — The Potgietersrust Platinum, Ltd., report for the quarter, ending June 30, states that the crosscut on Sandsloot from No. 1 shaft gave values of 3.7 dwt. platinum over 20 ft. and carried 0.69 per cent nickel and 2.9 per cent copper. The copper and nickel contents will be recovered as byproducts by the flotation process. On the Vaalkop-Zwartfontein portion, three bore holes gave: 8.4 dwt. platinoids over 13 ft., 6.07 dwt. over 23 ft. and 4.3 dwt. over 5½ ft. A fourth bore-hole gave 6.2 dwt. over 5½ ft. A vertical shaft is being sunk, in the line of the three bore holes, which should intersect the reef at a depth of 80 ft. On the Zwartfontein-Central ore-body, assays indicate that the orebody is at least 50 ft. wide, of an average value of 7 dwt. A reduction plant is being erected and it is expected to be in operation by September.

Transvaal Platinum, Ltd. reported, on July 20 that its reduction plant milled 817 tons during June producing 104 oz. of platinum and allied metals. Experimental work is being conducted with the object of improving the recovery. In May, 1,055 tons of ore milled gave 123 oz. platinoid metals.

Interest in Oil Shown

About 26 miles beyond Springs, in the direction of Bethal, a bore hole was sunk, some fifteen years ago, to a depth of 636 ft., on the farm Gruisfontein. This bore hole has been yielding a flow of natural gas, which kills vegetation in the vicinity. A party of experts, including H. J. Ibbotson, (a well-known gas engineer) visited the bore hole July 26. On fitting a gas-cock to the mouth of the enclosed hole, the gas, when lit, gave a flame 40 ft. high. A syndicate named the Devon Petroleum Prospecting Syndicate is investigating the occurrance.

Transvaal Gold Production Increases

The Transvaal Chamber of Mines analysis, for the first six months of 1926, shows that the value of the gold produced amounted to £20,449,515, an increase of £387,633 over last year's figure, for the corresponding period. The output in fine ounces, for the first half of this year, was 4,889,196 as again 4,784,115 in the first half of 1925.

The Boksburg Gap Gold Mining Areas, Ltd., published the assay results, last week, of fourteen samples from the No. 1 bore hole. The values are disappointing and average less than 1 dwt. per ton. The No. 8 sample over 16½ in. was the highest and it only carried 2.3 dwt. fine gold per short ton.

The following crushing results for the month of July, from fourteen leading Rand gold mines, have recently been published. The mines are arranged in order of profits earned:

Transvaal Production

	Tons Crushed	Value, or Revenue	Cost per Ton s.	d.	Estimated Profit
Government Areas.....	208,000	£396,179	16	1.2	£230,235
New Modder.	135,000	296,003	17	6.5	177,620
Crown Mines.	229,000	295,000	18	5.2	83,950
Modder Deep	45,400	102,172	15	2.0	67,657
Springs.....	70,200	131,647	19	1.9	64,407
New State Areas.....	79,000	134,487	19	11.0	56,091
Brakpan.....	86,200	137,948	19	1.2	55,636
Van Ryn Deep	71,000	109,345	16	4.4	51,690
Modder B....	67,000	112,762	18	3.1	51,591
Geduld.....	83,000	119,760	17	2.0	48,585
Randfontein Estates.....	200,000	212,201	17	11.8	34,558
City Deep....	103,000	151,234	22	10.2	33,567
West Springs.	52,300	81,109	18	2.7	33,457
Robinson Deep	78,200	.....	17	5.0	30,641

Charles Gardthausen, of Pretoria, who has been mineralogist and assayer, for the past 23 years, to the Geological Survey will shortly retire on a well-merited pension. Interviewed recently, by a *Star* correspondent, he spoke with optimism of the outlook for base minerals in South Africa. He made the first commercial tin assay, in the Transvaal, over twenty years ago.

In a report recently issued by the Witwatersrand Rock-Burst Committee, the chief assistant at the Union Observatory, Johannesburg (Mr. H. E. Wood), reported that the seismograph had recorded 5,427 tremors in 14 years, from July 1, 1910, to June 30, 1924. Of these, 2,986 were light shocks, 1,557 of medium intensity and 884 had been strong shocks.

Eerstegeluk Platinum Mines, Ltd., recently reported, for the month of June, an average value of 5.3 dwt. platinoids over 39 in. for 805 ft. sampled on Kroondal and Klipfontein farms, in the Rustenburg district.

On the Johannesburg Stock Exchange, during the past week, the share market has been fairly active, though London business has been quieter. Sub-Nigels have again been bought on a great scale and their price has risen, during the week, from 55s. to 60s. 9d. Tanganyika Diamonds have improved nearly 3s. rising from 13s. 1½d. to 16s. (sales). T. C. Lands rose to 54s. 6d.

Copper Ore Reserves for Forty Years

The copper ore reserves of the United States owned by 138 companies are placed at 1,588,000,000 tons by the Federal Trade Commission in its report of national wealth. Of the reserves 39 per cent are in Arizona; 25 per cent in Utah and 11 per cent in Michigan. Based on an annual production of 45 million tons of copper ore, the supply will last 40 years.

"As in the case of other mineral resources, estimates of reserves are increasing through discoveries of new deposits, use of ores with lower metal content through improved mining and refining processes, economies in production, or increase in price," says the commission.

The commission received reports of valuation of deposits from 17 companies owning 10 per cent of reserves. Only a few copper companies furnished data requested by the commission. It says that nearly half of the reserves are controlled by four companies; 6 control 26 per cent; 6 control 12 per cent; and 110 control 6 per cent.

Washington News

By PAUL WOOTON
Special Correspondent

Almaden Quicksilver Mines Operated More Than 2,000 Years —Ore Reserves Large

At the Almaden quicksilver mine, in the province of Ciudad Real in Spain, M. Van Siclen, assistant chief mining engineer of the Bureau of Mines, on the occasion of a recent visit found great interest in the mercury boiler. If that invention should come into general use all the quicksilver needed will be available in the Almaden mine, Mr. Van Siclen believes. There was no evidence of a disposition to encourage this new use of mercury by making the material available at the lowest possible price commensurate with a medium profit. On the contrary, were there to be any sharp increase in the demand for quicksilver, he would expect rather to see the price advanced to the highest point the traffic would bear.

While all the untoward features that usually surround government ownership and operation are in evidence in connection with the Almaden mine Mr. Van Siclen expressed the opinion that the actual mining is being conducted skillfully and efficiently. The treatment plant, however, is old and the losses are excessive.

Mercury has been mined in the Almaden region since the days of the Romans. There is reference in literature as early as 332 B.C. to the traffic in quicksilver with the Greeks and the Romans. The Carthaginians were in control of the properties for a time. The mines were worked by the Arabs during their control of the region. From 1151, when the Spanish under Alfonso VII retook the mines there is a continuous record of the operation of the properties. From 1499 to the end of 1925 production has amounted to 2,847,163 tons of mercury.

China Grants Lead-Antimony Concession to Germans

According to a report from Hamburg a number of German export firms of that port have received Chinese offers in which, for the supply of arms, ammunition and other articles, mining and other concessions are being offered. The firm of Schnabel, Gaumer & Co. of Hamburg has been granted a concession by the Government of the Province of Kwangwei (South China) for the exploitation of a number of lead and antimony deposits in that province, for a period of from ten to fifteen years. The Chinese are entitled to charge their Hamburg bills for goods supplied against taxes levied on the ore mined.

Power for Sullivan Mine

The West Kootenay Power & Light Co. has begun work on a new 60,000-hp. installation, at Bonnington Falls, for metallurgical purposes at Trail, and the East Kootenay Power Co., which supplies power to the Sullivan mine and the Crow's Nest Pass coal mines.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Beaver Consolidated Sells Kirkland Lake Shares to Develop Elk Lake Property—Ontario Silver Output Increases

The storm which has been brewing in the Beaver Consolidated Mines, Ltd., Cobalt, Ontario, has at last broken by the issuance of a circular by D. B. Hanna asking for proxies in the name of himself, Hume Cronyn and J. B. Tyrrell. Mr. Cronyn is head of the Huron & Erie Trust Co., and was one of the arbitrators in the Grand Trunk Railway award; Mr. Hanna was formerly head of the Canadian National Railways and is president of the Western Canada Flour Mills Co., while Mr. Tyrrell is the representative of the Anglo-French Exploration Co. in Canada and is consulting engineer for the Kirkland Lake Go'd Mines. No one questions the sincerity or business ability of either Mr. Hanna or Mr. Cronyn, who are among the big men of Canada, but their knowledge of mining is limited. The Beaver holds in its treasury 500,000 preferred shares and over 1,000,000 common shares of the Kirkland Lake Gold Mines and this represents practically the only asset of any value, which the company has. The chief ground for complaint is the sale of some of these shares at less than present market prices, to finance operations at the Beaver Auxiliary, a silver prospect controlled by the Beaver in the Elk Lake section. The opposition considers this money wasted, although the Beaver directors, before deciding to spend more money on the property, had a report made by Mr. Tyrrell, in whose name proxies are asked. The directors apparently considered the report favorable as they decided to spend the money on the property and this money had to be raised by the sale of Kirkland Lake Gold shares. Mr. Hanna apparently overlooks the fact that the development of new mining properties is a speculative venture and without taking this risk new mines cannot be developed. If the old Beaver directors had not taken a similar risk with the Kirkland Lake Gold property the Beaver today would be a forgotten memory, instead of a company with substantial holdings in its treasury which represent a large cash value. F. L. Culver, president of the company, has announced that he has no intention of running again, so that the verbal warfare would seem to have been unnecessary. There appears to be a growing demand on the part of the shareholders for a distribution of the common shares of the Kirkland Lake Gold held in the Beaver treasury. If a million shares were distributed in the form of dividend this would leave at least 500,000 preferred shares which are redeemable at 110.

The annual report of the Vipond Mines of Porcupine for the year ended July 31, shows that a total of 64,522 tons was treated, the recovery amounting to $565,995, or an average of $8.77 per ton. Operating costs were $490,516. After making provision for depreciation, taxes and the writing off undistributed development expenditures, the surplus stands at $58,070.

Silver production of Ontario mines for the first six months of the present year amounted to approximately 4,700,000 oz., an increase of 130,000 oz. as compared with the corresponding period of 1925. It is expected that there will be a substantial increase in the latter half of the year and that total silver production for 1926 will exceed any previous three or four years. This increase will be due largely to South Lorrain and Gowganda.

The report of the Ontario Department of Mines for the first six months of 1926 shows that there has been a substantial increase in the quantities of ore raised and ore smelted in the nickel district. During the period 660,155 tons of ore was smelted, an increase of 43,000 tons; 39,279 tons of matte was shipped containing 19,619 tons of nickel and 11,896 tons of copper. The International Nickel Co. is starting on a big program of expansion in the Sudbury district. At the Flood mine where over 100,000,000 tons of ore has been indicated by the diamond drills, two large shafts will be sunk which will be designed and equipped for a capacity of 10,000 tons a day.

The Grace and Star properties in the Michipicoten district have been taken over by a new company, the United Algoma Mines, Ltd., with a capital of 5,000,000 shares of $1 par and a total of $75,000 in bonds; $68,000 in bonds and 1,670,000 shares of stock were paid for the property. W. E. Simpson, the consulting engineer, has recommended an expenditure of $250,000 for the development and equipment of the property and the construction of a 100-ton mill.

In the same district the Pioneer Syndicate is developing the Copper Gold Mines. Underground work has been stopped to permit the sinking of a new vertical shaft.

During August, the Dome Mines, of Porcupine, treated 48,100 tons of ore, having a grade of $6.74 a ton with a recovery of $324,000. This is the same recovery as the preceding month, but the tonnage constitutes a new high record for the property.

Sulphur Lands Leased to Freeport

The Freeport Texas Co. has leased sulphur rights on the Allen dome, about ten miles from Freeport, Texas, from the Roxana Petroleum Co. to prospect for sulphur. One well drilled in search of oil shows good sulphur and other wells will be drilled in the near future. The dome is on a river assuring ample water supply for mining operations.

North Butte Leasers Make Shipments

Leasers at the North Butte Mining Co.'s "hill" properties at Butte, Mont., in the half month ended Aug. 31, shipped 48 cars of zinc and copper ore. Leasers are now employing 120 men underground.

Melbourne Letter

By Peter G. Tait

Special Correspondent

Gold Producers Want Government Aid—Heavy Shipments of Gold to America

Melbourne, Aug. 17.—J. Horsburgh, assistant general manager of the Mount Morgan Co. for the past nine years, has been appointed chairman of the Northern Australia Commission. The Northern Territory was taken over from South Australia by the Commonwealth Government some years ago. It is a sparsely populated area and has always been a "white elephant." There is good pastoral country, and promising mineral deposits—gold, copper, silver-lead and tin. The Commission will have many problems to face in its efforts to develop primary industries, but it is certain that they will give some attention to mining.

A parliamentary deputation organized by the Gold Producers' Association recently waited on the prime minister (Hon. S. M. Bruce) to urge that assistance should be given to the gold mining industry. Mr. Bruce informed the deputation that the ministry had decided to invite the Development and Migration Commission, of which H. W. Gepp is chairman, to investigate and report upon the whole subject.

The S.S. *Tahiti* which left Sydney on Aug. 12, took on board £1,000,000 in gold for America. This shipment made the fifth of its kind, approximately £5,000,000, or 40 tons of gold which has been shipped in the last few months.

Mica Mines Under Development

Mica occurs in several places in Australia. The deposits in Central Australia have been worked more or less spasmodically for a number of years. The difficulties of transport and the absence of adequate marketing facilities are mainly responsible for the industry not being established on something like a sound footing. A London company, the Australian Prospecting and Development Syndicate, is making a systematic attempt to exploit one of the Western Australian deposits, namely, Yinnietharra, 240 miles east by north from the port of Carnarvon. A small factory has been erected on the field under the supervision of an expert and the first shipment of 43 tons has been sent to London. The North Queensland mines have also produced small parcels intermittently and marketed locally. Reports indicate that the Australian deposits are worthy of development.

The Waihi Grand Junction mine at Waihi, New Zealand, has been closed down since February, 1925, owing to prospecting operations at depth and laterally proving abortive. The company holds an area of 911 acres, which offers abundant scope for prospecting, but additional capital would have to be raised for this purpose. New capital not being forthcoming, the company has entered into an arrangement with the Waihi Company to work the mine, the profits, if any, to be equally divided between the two companies. It is

understood that the Waihi Company will extend its drives into the Grand Junction workings, and that the ore will be sent to the Waihi mill.

About 5,000 oz. of gold won from the Bulolo River and Edie Creek, in the mandated territory of New Guinea, was brought to Sydney by the steamer *Marsina* on her last trip. There are about 40 miners now operating in the district, and a similar number are held up at the port of Salamoa, being unable to obtain labor to carry their stores. It is necessary for each prospector to have with him about 30 native laborers.

News has been received from London that a company is being floated to work the Federation tin mines in Tasmania. The local company spent a certain amount of money in opening up the property but operations have been at a standstill for the past year.

Chilean Nitrate Industry Depressed

The number of nitrate plants in operation has declined from 91 at the beginning of this year to 49 at the end of July, according to the U. S. Department of Commerce. The exports during the recent months have been at a rate considerably below production with the result that stocks at the nitrate ports have increased to an unusually high point. In addition, large stocks are being held for orders at most of the producing plants and the principal markets of Europe.

Russian Potash Deposits Large

For some time systematic borings have been made for potash near Solikiamsk, in the Perm district. The borings now show, says the *Taegliche Rundschau*, that these desposits are the biggest yet found in the East; their extent is said to be no less than that of the German deposits. According to the borings made, deposits of 100,000,000 tons of potash have been ascertained. It is stated that the Russian Government is preparing for the working of the newly found deposit.

Clay Output Increased in 1925

The quantity of clay sold by producers in the United States in 1925 amounted to 4,030,420 short tons, valued at $12,736,632, or $3.16 a ton, according to the U. S. Bureau of Mines. These figures show an increase of 9 per cent in quantity and 11 per cent in value compared with 1924. They represent only clay sold as clay or mined under royalty and do not include the much greater quantity of clay that was burned into clay products by the producers themselves from their own property.

The sales of kaolin, the clay that is used in making high-grade pottery and porcelain, as well as paper, oilcloth, and other products, and which is generally considered the highest grade of clay, amounted to 367,319 tons, valued at $3,220,719, an increase of 12 per cent in quantity and 10 per cent in value as compared with 1924. The sales of fire clay in 1925 were the largest ever recorded—2,566,934 tons—valued at $7,312,349.

London Letter

By W. A. Doman

Special Correspondent

"Cleaner" Mining Finance Becoming Popular on the Rand

London, Aug. 31 — In his standard book "Money and Mines" Hugh F. Marriott reiterates the policy he has for years advocated—cleaner mining. The question is cropping up again as regards the mines of the Rand. It is strange how periodically the alternatives of big tonnage and low costs per ton, and narrow stoping and high costs, are brought under discussion. Mr. Marriott does not believe in a forest of stamps to crush the equivalent of paving stones. In the past, juggling with the question has lengthened or shortened the "life" of a mine, and has unquestionably influenced the share market. Mr. Marriott goes in for mining as mining, and lets the share market, so to say, "be blowed." His views simply met with adverse criticism and if he impressed certain parties, his views were not followed. The matter has come to the forefront again now by the methods of clean mining adopted at the Sub-Nigel (Far East Rand). Stopes are carried as narrow as 2 ft. and on this basis certain interested parties have been calculating profits. Some of them have allowed their fancy to run riot, for the official figures are much more moderate. At June 30 a recalculation of the ore reserves gave them as 731,000 tons, averaging 17.5 dwt. over 28 in. Twelve months earlier the figures were 509,000 tons, 12.2 dwt., 39.2 in. Unofficial estimates have given 950,000 tons at 17.5 dwt. Clearly the management is not on the boosting tack, and shareholders are grateful for the information. Now that the Sub-Nigel has demonstrated what can be effected by cleaner mining, the managements of other properties are introducing the same system. After all it is not tonnage that investors want, but real profits, that is, a return of capital and something in addition.

Mr. Bleloch has rather disappointed the market here by his procedure in regard to the Boksburg Gap. A cablegram to hand states that the directors have decided not to assay the second half of the reef core from No. 1 borehole, as it is likely to be of more use for correlation with the reefs that will be cut in the No. 2 borehole. (The first assay was unpayable). Mr. Bleloch wants shareholders in his company to wait until five prospecting shafts have been sunk. It is hoped that his optimism will be warranted, though it seems to be hoping against hope.

The share market was rather disconcerted yesterday at the news cabled from Simla that a landslide occurred at the Tiger Camp of the Burma Corporation mine, on August 16, when forty-three persons were killed. The company has now issued a notice to the effect that the accident was due to excessive rainfall. The mine itself has not been injured.

Shareholders in the Mawchi Mine (Southern Shan States) which produces tin and wolfram, have received a shock. Many of them acquired their interest at about 25s. which incidentally gave a handsome profit to the reconstructors, who are credited with having got in at 8s. The mine is reported to be in a backward state partly accounted for by the fact that the principal veins are now in granite, and that transport has been delayed owing to the heavy rains.

British Columbia Mines Operating at Full Capacity

The large concerns continue to operate at the capacities of their respective plants. The Consolidated Mining & Smelting Co. of Canada is turning out around 20,000,000 lb., of copper, 16,000,000 lb. of zinc, 1,750,000 lb. of lead, 500,000 oz. of silver, and 4,000 oz. of gold per month. The Granby Consolidated Mining, Smelting & Power Co. is turning out 750,000 lb. of copper from its Anyox plant and 1,250,000 lb. through its subsidiary, the Allenby Copper Corporation; the latter is smelted at Trail, and, therefore, should be deducted from the Consolidated company's output. The Britannia Mining & Smelting Co. is producing 3,000,000 lb. of copper per month.

B. C. Silver Mines now has developed five important ore shoots on the Premier ore zone, to the north and west of the Premier Gold Mining Co.'s territory. Recent diamond drilling from the 331-ft. level has demonstrated the existance of a shoot for a length of 400 ft., assaying up to $20 per ton over a width of eight feet. The company is shipping around 200 tons of picked ore per month, all won from development work. As yet it is contented to continue development, wisely leaving the erection of a mill and the provision for transportation of ore until a large body of ore has been blocked out.

Three promising deposits of lead-zinc ore, carrying important values in precious metals have been opened at the surface in the Marmot River section of the Portland Canal mining division.

F. H. Taylor has driven about 80 ft. across the new discovery, near Topley, on the Canadian National Railway, and has made a shipment of ore from this tunnel, the result of which has not yet been received. Several engineers have examined the property, which, however, is being held at $200,000, with only two weeks allowed for sampling.

Porcupine Goldfields Development & Finance Co. has taken a lease and option on the Lynn Creek zinc mine, near North Vancouver. Newton Emmons did some exploration on this property during the war, but dropped it at the cessation of hostilities. Two years ago A. B. Trites and associates did a little development. There is a considerable body of ore exposed on the surface, which is said to average 10 per cent of zinc, with no other values.

The Hecla Mining Co., Wallace, Idaho, has bonded the Stampede group, on the British Columbia side of the International boundary, about 50 miles from Haines, Alaska. There is said to be a large surface exposure, assaying from $10 to $70 in gold and silver.

The Canadian Pacific Railway Co. is spending $100,000 on yard improvements at Kimberley, including sheds, a roundhouse, and new trackage, to facilitate shipping at the Sullivan mine.

Situation at the Mines

By Albert H. Fay
Assistant Editor

The slight increase in the price of lead and copper continues to stimulate production of these metals. Michigan and Montana particularly report a shortage of skilled miners. On the whole there is no reason to complain about

Average Prices, March, 1926, to August, 1926

Period	In Cents			
	Copper	Lead	Zinc	Silver
Average, 1925	14.042	9.020	7.622	69.065
March, 1926	13.859	8.386	7.332	65.880
April	13.706	7.971	7.001	64.409
May	13.599	7.751	6.821	65.075
June	14.656	8.033	7.112	65.481
July	13.924	8.499	7.411	64.793
August	14.174	8.908	7.376	62.380

conditions in the mining field if we take into consideration the excess-profits taxes of 1917 to 1920, and the low ebb of 1921. The demand for metals continues and will increase as European conditions become more stable.

Copper—Smelter activity is a good indication of the trend in the copper industry, there being but few idle units in the refining plants in the Michigan district. The August production was absorbed, and orders are coming in at a satisfactory rate for September and October deliveries. The major part of the lake output was marketed to the domestic trade, and European business for the month was the smallest in the year. The August production of Calumet & Hecla was 8,575,000 lb. out of a total of 14,175,000 for the entire Michigan district. The Calumet & Hecla is installing an electric hoist on the 81st level and conducting extensive underground exploration work. There is also an interest shown in the matter of acquiring additional copper-bearing lands and especially those which have been productive in the past but with grades of ore too low to work under former metallurgical practice. The survey of the Michigan copper mining and milling methods has begun by the U. S. Bureau of Mines, the Michigan College of Mines, and the mine operators all working in co-operation. In Arizona the mines are operating at practically full capacity and the smelters likewise. A suit has been filed by the Carson Investment Co. against a number of Arizona copper mining companies in connection with the use of and infringement of Carson's alleged patents. Regular copper shipments are now being made from Arizona points via the Panama Canal to eastern refineries at a slight reduction in freight rates. The Utah Copper Co. has completed the electrification of its steam shovels and is employing about 1,500 men and handling 35,000 tons of ore per day. The same company is testing the use of oil-electric and electric engines, having in view the replacement of its present steam locomotives. The Nevada Consolidated has completed its four-compartment Ruth shaft, which, while not so deep as some in Butte and Michigan, will have with its new hoist of 10,000 tons daily capacity, one of the largest tonnage possibilities of any shaft in the United States. The Mason Valley smelter at Thompson, Nev., has been operating since Aug. 10, thus giving an outlet for local ores. The Idaho Copper Corporation was overruled in its action against the Idaho State Mine Inspector. As evidence of the activity in British Columbia, twenty-four mines owned by individual companies shipped in seven days, ended Aug. 21, a total of 13,042 tons of high-grade ore to the smelter at Trail. In Manitoba the Flin Flon property is being made ready for a pilot smelter.

Gold—Though there has been a decline in production in recent years, and an absorption of more than 100 per cent of the United States' gold output by India, there continues to be considerable activity in this branch of the mining industry. In Canada the largest gold mine, the Hollinger, is increasing its capacity and sinking a number of additional shafts. The Dome Mines dropped its Howey option due largely to the terms of the contract being too severe and rigid. The La Rose gold mine is undergoing a reorganization. The McIntyre is milling a lower grade ore but a larger tonnage results in increased production. A number of new mills have been completed recently in Ontario and put in operation. In the Kirkland Lake district efforts are being put forth to increase the percentage of recovery from the ore mined, and cheaper electric power is also assured. In Alaska three dredges are operating at Fairbanks. The Golden Center dredge at Candle Creek, Alaska, is operating successfully and is reported as recovering $27,700 in its first twelve days' run. The Alaska Juneau continues to operate at a deficit. A new dredge has been put in operation near Boise, Idaho, and in Breckenridge County, Colorado, there is a renewed activity in the matter of dredging operations. In Nevada, the Gilbert Mammoth Last Hope Mines Co., suspended operations due to a disagreement among the stockholders. None of the other mines in the Gilbert district have as yet reached a producing stage of any importance. In the Randsburg district, California, a number of small gold mines are resuming operations.

Zinc—In the Joplin-Miami district 169 mills were in operation during August, and the zinc and lead ore production was sufficiently large to prevent additional advances in ore prices. The accumulated zinc concentrate stocks in the bins at the mines on Aug. 31 was 28,500 tons, lead concentrate 12,100 tons, much of which is held for better prices. The weekly production of zinc concentrate was about 17,000 tons and sales about 16,000 tons. The Anna Beaver Company at Cardin, Okla., is carrying out an extensive drilling campaign over a large acreage. Work is well under way in the construction of the electrolytic zinc plant at Kellogg, Idaho, which will open up a market for many of the small mines that can produce zinc concentrate as a byproduct. In Finland large zinc-lead deposits are under development and initial production. These mines were originally worked for their copper content, zinc and lead being discarded. Announcement is made by the Quebec Bureau of Mines that a zinc smelting plant will be erected in the Lake St. John district of Northern Quebec. This will be of considerable importance for the Rouyn mines, several of which have deposits of zinc. Zinc ore is also produced in the Sudbury district of Northern Ontario and may be shipped from there to the Lake St. John smelter. These mines have previously been obliged to ship zinc ore to Belgium. Improved shipping facilities are reported from Tampico which will expedite zinc shipments from Mexico.

Lead-Silver—At Park City, Utah, the main operations are centered in the two groups, the Park-Utah Consolidated and the Silver King Coalition, both working at full capacity. The Park-Utah is shipping more than 5,000 tons of concentrates per week, and the Silver King about 1,500 tons. At Tintic, shipments are steadily maintained at a total of about 217 carloads of concentrates per week. A 250-ton mill is under construction for the Federal Mining & Smelting Co. at the Page mine, Kellogg, Idaho. Cœur d'Alene companies are active in developing lead-silver mines in Custer County, Idaho. The Jack Waite mine, Kellogg, Idaho, is milling 150 tons per day. The Star mine, Burke, Idaho, is developing large zinc, silver, lead orebodies. Announcement has been made by the Hecla officials that the change room built less than two years ago is too small to accommodate the 600 men employed in the mine, and that additions now under construction will double present capacity. Fire destroyed the main buildings and much equipment of Amalgamated Pioche at Pioche, Nevada.

Iron—The iron-ore movement from Lake Superior district during August establishes a high record. Mining operations are being increased on all the Minnesota ranges. An especially interesting development is the resumption of shipments from mines that have been idle for a number of years. The mines of the Vermilion Range of Minnesota have been shipping heavily during the last few weeks from both underground workings and stock piles. Henry Ford is beginning work on the Palms-Book iron lands on the Marquette Range, in Michigan. A number of mines on this range have resumed shipments of low-grade siliceous ores.

Miscellaneous—The Consolidated Mining & Smelting Co., in British Columbia, is seeking phosphate deposits to utilize its waste sulphur. A Los Angeles corporation is planning to develop potash deposits in Utah, the existence of which was shown in the recently completed oil wells. Substantial manganese shipments from the Harriman's Soviet concession have been made during recent months, the total being almost half a million tons for the first year's operation. Platinum returns from South Africa are disappointing.

Societies, Addresses, and Reports

Self Rescuer and All-Service Gas Mask Prove Value

T. J. Ryan's Paper at Recent Safety Meeting in California Attracts Interest—Devices Use Hopcalite

Probably the most interesting of the safety discussions at the recent first aid and mine rescue meeting in San Francisco, and one applying especially to the mining field, was J. T. Ryan's paper on the all-service gas mask and the self-rescuer. Both of these devices have been made possible by the development of a catalyst, Hopcalite, which has the property of oxidizing carbon monoxide in the presence of oxygen and the absence of moisture to carbon dioxide. In the all-service gas mask, respiration is effected through a canister charged with layers of activated charcoal, caustic, calcium chloride, Hopcalite and calcium chloride. The self-rescuer is similar in principle. Most noxious gases can be removed by absorbents but carbon monoxide has been the most difficult to eliminate. The catalytic has proved to be effective.

"The Bureau of Mines, in its investigation of gas masks in mines and allied industries, has established a permissible schedule, 14 A, under which masks that meet their requirement after being submitted to exhaustive tests are granted a certificate of approval. The All-Service gas mask has been approved by the Bureau of Mines under this schedule for respiratory protection in mine atmospheres where safety lamps are burning, and for use above ground in air that contains acid gases, organic vapors, or carbon monoxide not exceeding 2 per cent by volume, ammonia not exceeding 3 per cent, and in smokes, dusts and mists—or not exceeding 2 per cent of poisonous gases when more than one gas is present.

"The final test of the Bureau for approval was to subject the mask to an actual working test by three men wearing it in an unventilated, gas tight chamber of 1,000 cu. ft. capacity, to which had been added the following gases in the percentages as stated, and determined by analysis: Sulphur dioxide, 1 per cent; carbon tetrachloride, 1 per cent; ammonia gas, 2 per cent, and again at 0.5 per cent; and cotton smoke, the density of which was such that the hand was invisible at arm's length.

"The three men wore the masks for a thirty-minute period in each of these concentrations, performing, successively, hard work, walking, and running. The Bureau's published report of the approval states that 'The masks gave good protection throughout all of these tests; they were comfortable and there was little interference with movements; vision was good and of fairly wide angle; and resistance to breathing was tolerable through all the work required.'

"In addition to the actual wearing tests of the complete masks, the canister was subjected to separate tests against the following gases: Chlorine, hydrocyanic acid gas, sulphur dioxide, phosgene, carbon tetrachloride, gasoline, ammonia and carbon monoxide, in varying percentages required by the schedule, from one-half of one per cent of sulphur dioxide to 4 per cent of carbon tetrachloride and ammonia, and 1 per cent of carbon monoxide under the worst possible conditions for the operation of Hopcalite, namely, at a temperature of O°C and 100 per cent relative humidity. The air flow in these tests was 32 liters per minute, about the rate of breathing for the average man when working, and some tests were made at 64 liters per minute.

"This test against 1 per cent of CO was for a period of 460 minutes, or seven hours and forty minutes, without CO coming through the cannister. We have, in our laboratory, run cannister tests under more normal conditions of temperature and humidity for days without CO coming through when the air flow of 32 liters per minute contained 1 per cent of CO."

American and Canadian Engineers Meet at Spokane

A joint meeting of the British Columbia branch of the Canadian Institute of Mining and Metallurgy and the Northwestern section of the American Institute of Mining and Metallurgical Engineers will be held on Oct. 13 and 14 at Spokane, Wash., on Oct. 15 there will be an excursion to Kimberley, where the attending members will be shown over the Sullivan mine.

Power Show Next December

The next National Exposition of Power and Mechanical Engineering will be held in the Grand Central Palace, New York, Dec. 6 to 11. It is the fifth annual exposition to be held. Each year these exhibitions have grown in scope, size and attendance. This year four floors of the Grand Central Palace will be required for the exhibits of mechanical equipment, including power generating, power using, and mechanical power transmission devices. Four hundred and fifty manufacturers will be represented.

Safety Congress in Detroit Oct. 25-29

Invitations have been issued to the Fifteenth Annual Safety Congress to be held at Detroit, Mich., Oct. 25 to 29 by the National Safety Council. The meetings will be held at the Book-Cadillac, Statler and Tuller Hotels.

The meetings of the mining section will be held at the Tuller Hotel. B. C. Yates, superintendent of the Homestake Mining Co., will act as chairman. Among the papers to be presented is one by C. S. Hurter, of the technical department of the E. I. du Pont de Nemours & Co. entitled "Safe Methods in Blasting Operations in the Lake Superior District Mines, Underground and Open Pit." Also a paper entitled "Methods of Promoting Safety Interest in the Homestake Mine" by A. J. M. Ross, general mine foreman of the Homestake company.

Princeton Summer School Completes Tour

The Princeton Summer School of Geology and Natural Resources, under the direction of Prof. Richard M. Field, has completed a six week's tour of the United States, in a Pullman care especially constructed for the purpose. The party included twenty-four, among them being two foreign guests, Dr. A. H. Westergard, of the Geological Survey of Sweden, and Mr. T. C. Nicholas, Fellow of Trinity College and lecturer in geology at the University of Cambridge, England. The travelling instructors this year were Prof. Field and Prof. A. F. Buddington. Other members were: Prof. C. E. Gordon, chairman, department of geology of Massachusetts Agricultural College; Prof. J. L. Rosenholtz, of Rensselaer Polytechnic Institute; L. L. Lee, of the Agricultural Experiment Station, New Brunswick; and undergraduate and graduate students from several different eastern universities.

During the trip the party studied in seven of the National Parks; the clay pits of New Jersey, Spokane, Washington; the coal mines at Wilkes-Barre, Pa.; the Mesabi Iron Range; the Leonard copper mine, at Butte, and the Anaconda smelter; the oil fields of the Los Angeles basin; the San Francisco Mountains, and the Painted Desert.

Among those who acted as guides and instructors to the party in the field were: Dr. J. Walter Fewkes, Smithsonian Institute, Washington; Dr. David White, U. S. Geological Survey; Prof. W. A. Parks, Toronto University; L. K. Armstrong, mining engineer, Spokane; Charles M. Butler, General Petroleum Corporation, Los Angeles; Desaix Myers, Union Oil Co., Los Angeles; Dr. Harold S. Colton, University of Pennsylvania; B. M. Concklin, chief engineer, Arthur Iron Mines Co., Hibbing, Minn.; Professor Henry S. Conard, Grinnel College, Iowa; J. C. Sloane, Pasadena, Calif.; Ansel F. Hall, National Park Service, Department of the Interior; William B. Daly, Manager of Mines, Anaconda Copper Mining Co., Butte, Mont., Professor Morton J. Elrod, Montana State University.

Postgraduate School at Tucson

With Dr. F. L. Ransome, geologist, and former member of the U. S. Geological Survey at its head, a graduate school has been created at the University of Arizona at Tucson. Last year, 132 students took advanced courses, in which thirty degrees were conferred. Already 320 applications for admission as freshmen have been received, with 15 per cent being rejected.

Will Study Timber Treating

A fellowship has been established in the Carnegie Institute of Technology under which the Institute and the Bureau of Mines will conduct an economic study of the relative efficiency and costs of timbers treated by different methods and with different preservatives. The Mellon Institute, the Forest Service, the American Wood Preservers' Association, Pennsylvania Coal Mine Operators, and the makers of preservatives are interested.

Recent Technical Publications

Reviews, Abstracts, and References

For British Coal Miners

The Mining Educator. Edited by John Roberts. Isaac Pitman & Sons, New York. 2 vols. Price $17.50.

This is an exhaustive treatise on British coal-mining practice, each of the various chapters being prepared by men said to be thoroughly familiar with the subjects to which they have been assigned. It is intended as a work of reference for "firemen, examiners and deputies, shotfirers, mine surveyors, under-managers, and managers," and also for students wishing to prepare themselves for those positions. Some effort has been made to treat of other forms of mining than coal, and of milling methods, but the work is essentially of value to the coal miner. Though there are chapters on "ore dressing and milling," the treatment is limited. The arrangement of the books is unusual in that no particular system seems to have been followed in classifying the subjects for the various chapters. A chapter on mine ventilation, for instance, is followed successively by chapters on mine illumination, the origin of anthracite, another on mine ventilation, coal-face machinery, chemical aspects of coal, mining law, practical mathematics, breaking ground, mine drainage, the origin of anthracite again, and then another on mine ventilation. The two volumes are rather ponderous, containing 1,770 7x9½-in. pages.

Henry Ford's Latest Book

Today and Tomorrow. By Henry Ford, in collaboration with Samuel Crowther. Doubleday, Page & Co., New York. Price $5.

If you have not already done so, you should read this book. In the first place, the factual material is of absorbing interest; in the second place the style of the writing (Mr. Crowther's, of course) makes delightful and fascinating reading; and in the third place, the philosophizing on social and economic problems is mightily stimulating even if you cannot agree with everything that is said.

The ordinary man once was inclined to extol Henry Ford as a manufacturing genius incomparable in the sphere of organizing shop work for economical mass production; and then to belittle his capacity in other directions. "My Life and Work," published a year ago, revealed to the world a different figure. There loomed a personality more significant perhaps than any other in his generation; and the present book in elaborating and defining his theories and principles (always illustrated by the actual achievements in his own huge industries) has added to the stature of the man.

"The only slave left on earth is man minus the machine," says Ford, and he argues that these slaves can be liberated if management is sufficiently skillful. The biggest burden rests on the head of the industry: he must make it possible for the worker to accomplish enough to *earn* high wages, which in turn will enable him to buy the products of the manufacturer. The Ford cycle includes high wages, large purchasing power, high production rates, low cost to consumer. A five-day week gives the worker a chance to do something besides produce; but while he is on the job he must WORK. And in the end the product is a little more of happiness for the human race. "Altruism," says Ford, "clogs progress." He abhors philanthropy, and yet his earnest hope is to help make the world a better place for "common" folks to live. His methods perhaps are revolutionary; but they are practical and they smack of common sense.

Contrary to the suggestion of the title, virtually all of the book deals with today, not with tomorrow. The concluding paragraphs are significant: "We are not living in a machine age. We are living in an age when it is possible to use power and machinery in the public service—and at a private profit. But what of the future? Shall we not have overproduction? No man can say anything of the future. We need not bother about it. The future has always cared for itself in spite of our well-meant efforts to hamper it. If today we do the task we can best do, then we are doing all that we can do. Perhaps we may overproduce, but that is impossible until the whole world has all it desires. And if that should happen, then surely we ought to be content.

A. B. PARSONS.

Patents

Patent specifications are not sold by "Engineering and Mining Journal" but may be obtained for 10c. each from the Commissioner of Patents, Washington, D. C.

Roasting — No. 1,597,018. Aug. 24, 1926. M. F. Coolbaugh and J. B. Read, Golden, Colo., assignors to The Complex Ores Recoveries Co., Denver, Colo. Ore containing arsenic and antimony minerals is roasted in the presence of oxygen; the arsenates, antimonates, and metal sulphates then leached out; and the residue finally cyanided for gold and silver.

Concentrating Table—No. 1,597,066. Aug. 24, 1926. Emil Deister, Fort Wayne, Ind. A riffled table adapted for the concentration of coal.

Flotation Machine — No. 1,597,368. Aug. 24, 1926. S. E. Meyer, Hayden, Ariz. A flotation machine of the pneumatic type, with screens placed over the aerating compartment.

Gold Dredge—No. 1,597,580. Aug. 24, 1926. R. R. Dailey and Leroy Vorhies, Granite, Colo. Design for a hydraulic gold dredge.

Riffle Box—No. 1,597,705. Aug. 31, 1926. Oliver Adcock, Rocky Ford, Colo. A sluice box or riffle, having pockets of inverted cone shape, across the mouths of which baffles are placed.

Rock Drills

No. 1,596,873. Aug. 24, 1926. G. H. Gilman, Belmont, Mass. Design for a rock drill.

No. 1,597,245. Aug. 24, 1926. William Prellwitz, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. A cushioning handle for percussive tools.

No. 1,597,394. Aug. 24, 1926. F. M. Slater, Easton, Pa., assignor to Ingersoll-Rand Co. A valve for a rock drill.

No. 1,597,413. Aug. 24, 1926. Gordon Lee, Easton, Pa., assignor to Ingersoll-Rand Co. Design for a hammer drill.

No. 1,597,537. Aug. 24, 1926. G. M. Nell, Cleveland, Ohio, assignor to The Cleveland Rock Drill Co., Cleveland. A method of applying valve plugs to valve casings in rock drills.

No. 1,598,440. Aug. 31, 1926. C. C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. An oscillating valve for rock drills.

No. 1,598,589. Aug. 31, 1926. W. A. Smith, Athens, Pa., assignor to Ingersoll-Rand Co. A rock-drill oiling device.

No. 1,598,645. Sept. 7, 1926. C. C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co. A rotation mechanism for rock drills.

No. 1,599,197. Sept. 7, 1926. W. J. Barnett, Kenilworth, Transvaal, South Africa, assignor to Ingersoll-Rand Co. Design of a rock drill of the hammer type.

Waste-Heat Boiler — No. 1,597,718. Aug. 31, 1926. Plinio Bringhenti, Milan, Italy. An apparatus for the direct production of high-pressure steam by means of the heat contained in hot products such as coke, slags, and blast-furnace ashes.

Crusher — No. 1,597,207. Aug. 24, 1926. Alfred Molander, St. Paul, Minn. Design for a gyratory crusher.

Electrothermic Zinc Smelting — No. 1,598,176. Aug. 31, 1926, Filip Tharaldsen, Christiania, Norway. An even layer of coke is introduced onto the hearth of an electric furnace, to serve as a heating resistance, and upon this, a correspondingly even layer of zinc-containing charge. The zinc charge is continuously discharged after heating.

Copper Ore Treatment—No. 1,598,296. Aug. 31, 1926. H. S. MacKay, London, England. A complete process for directly producing electrolytic copper from sulphide ores, comprising roasting to make the copper soluble; leaching with sulphuric acid; purifying the copper sulphate solution to remove iron, aluminum, and other contaminants; regulating and controlling the acid and bases in solution; and depositing metallic copper, with regeneration of the sulphuric acid.

Hydrometallurgy — No. 1,598,858. Sept. 7, 1926. W. E. Greenawalt, Denver, Colo. An apparatus for treating liquids with gases, the gas being supplied under pressure through injectors.

Concentrator—No. 1,599,293. Sept. 7, 1926. A. W. Severance, Portland, Oregon, assignor to Gold Saving Machine Co., Portland. A machine for concentrating precious metals, comprising a flat-bottomed tank with triangular conduits, the tank being given a vanning motion.

People You Should Know About

Prof. Alan F. Bateman is in Butte on professional business.

Col. L. D. M. Baxter has been appointed secretary of the newly-formed Manitoba Chamber of Mines.

Percy E. Hopkins, representing the Mond Nickel Co., has gone to Michipicoten Island, Northern Ontario, to make an investigation of copper properties.

Oliver Cabana, president, and **E. L. Miller**, vice-president, of the Wright-Hargreaves Mines, Limited, in the Kirkland Lake district of Northern Ontario, have returned from an inspection trip to the property.

Walter J. M. Le Froy, editor of *Canada* of London, England, is visiting the Goudreau and Michipicoten mining areas of Northern Ontario.

Lionel Holland, chairman of the Mysore Gold Mines of India, and **Henry Taylor**, of the firm of John Taylor and Sons, of London, England, have been appointed directors of the central Manitoba Mines, Limited.

W. R. Clubb, minister of public works for Manitoba, accompanied by **F. M. Black**, ex-provincial treasurer, and **V. H. Campbell**, engineer in charge of the road construction through the Rice Lake district, are making a tour of inspection to the Lake Winnipeg mining field.

Among the younger mining engineers, who have advanced rapidly in the Butte camp, is **James J. Carrigan**, whose promotion to the position of chief assistant general superintendent of mines of the Anaconda Copper Mining Co. was recently announced. Mr. Carrigan entered the employ of the Anaconda company, shortly after his graduation from the Michigan School of Mines in 1908. He was successively employed as miner, shift boss, geologist, safety engineer and explosives expert. He was then put in charge of the Butte Copper & Zinc subsidiary and on account of his successful operation of that group received charge of all the zinc properties of the company in Butte. Two years ago he was made assistant general superintendent of mines.

Charles F. Ayer, president of the Magma Copper Co., accompanied by **W. A. Hutchinson**, vice-president of De Fremery & Co., of San Francisco, has been visiting the company's holdings in the Superior district.

W. A. Clark, Jr., who has been spending the summer in Montana, recently returned to his home in Los Angeles. Part of the summer was spent on his estate on Salmon Lake.

M. H. Merriss has resigned his position as assistant to the vice-president of the Nichols Copper Co. to accept an appointment as engineer to the Richard D. Wyckoff Analytical Staff, Inc. His address after Sept. 15, 1926, will be 42 Broadway, New York.

C. L. Lamb, underground manager of West Springs, has been appointed acting manager during the absence from South Africa of B. D. Bushell, who is on long leave in England with his family.

Irwin H. Cornell, vice-president of the St. Joseph Lead Co., has returned to New York after a six-weeks' vacation trip abroad.

Cleveland H. Dodge is spending some time in the southwest, visiting the mining properties of the Phelps Dodge Corporation and also making an informal inspection of the new main line section of the Southern Pacific, of which he is a director.

Robert D. Ferron, of La Paz, Bolivia, has just completed the erection of a chloridizing blast roast treatment plant

Robert D. Ferron

for the Sociedad Minas de Plata de Caylloma, at Caylloma, Peru. The plant follows the same general lines as the Tintic Standard plant at Harold, Utah, save that table and flotation concentrates averaging about 30 per cent sulphur are to be treated in the Holt-Dern furnace.

Charles Hardy, who has been on a business trip to Europe, returned to New York on the "S. S. Paris" on Sept. 7.

The appointment of **H. W. Gepp**, general manager of the Electrolytic Zinc Co. of Australia, as chairman of the Migration and Development Commission constituted by the Australian Commonwealth government, has lead to several changes in the ranks of responsible officials associated with two of the largest metallurgical concerns in Australia. **H. St. J. Somerset**, formerly of Mount Morgan, and now general superintendent of the Broken Hill Associated Smelters at Port Pirie, has been appointed general manager of the Electrolytic Zinc Co. **David Meredith** will be the general superintendent for the company in Tasmania. Mr. Somerset's services will be available to the Broken Hill Associated Smelters in a consulting capacity. The position of general superintendent at this establishment will be filled by the promotion of **O. H. Woodward**, who has been with the company for the last seven years. He was formerly with the Mount Morgan Co.

George Denny, accompanied by Mrs. Denny, arrived in Johannesburg from Rhodesia, on Aug. 5.

Errol Hay, technical adviser to the General Mining and Finance Corporation, Ltd., Johannesburg, has recently been in England. He underwent an operation on one of his ankles, which delayed his return by several weeks.

Professor R. A. Lehfeldt, who occupies the chair of economics in the Witwatersrand University, was due to reach Capetown, by the "Euripides," on Aug. 7, after his recent visit to Europe.

W. N. Tanner, chief engineer of the Anaconda Copper Mining Co., Butte, Mont., has been granted an indefinite leave of absence on account of ill health. **C. D. Woodward**, chief electrical engineer for the company, has been appointed as acting chief engineer. The change took effect Sept. 1.

Sir Joseph B. Robinson of Capetown, celebrated his eighty-sixth birthday on Aug. 3. He was the first to export diamonds to England from South Africa and was associated with the diamond industry for many years. He was created a baronet in 1908 and began disposing of his mining interests, gradually retiring from a vigorous career.

Sir Spencer Lister has been appointed director of the South African Institute of Medical Research, Johannesburg, in succession to Dr. Watkins Pitchford, who resigned on account of continued illhealth. He formerly acted as medical officer at the Premier diamond mine and the Durban-Roodepoort Deep. He has recently returned from a tour in Europe and the United States.

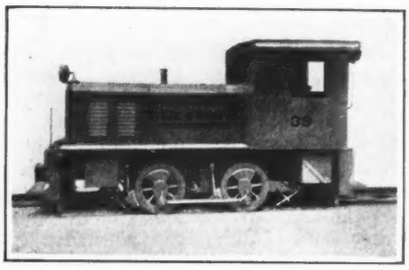
Latham Watson has been appointed by the Australian government to supervise the operations of companies and persons receiving grants in connection with oil prospecting. He has had extensive and varied experience in the oil world. After a term in the mining industry of Western Australia, he went abroad, and became associated with various oil-producing interests. Mr. Watson was in Roumania when the war broke out. During the war he was sent by his company to Trinidad to work valuable deposits there, and after the Armistice he returned to Roumania to help in the restoration of the works dismantled during the hostilities.

Obituary

Marcus L. Hewett, president of the Basin-Montana Development Co., Basin, Mont., died in Scranton, Pa., on Aug. 22.

John K. Merriman died at Stellenbosch (Cape Province) on Aug. 3, aged 85. For over half a century, he has been a prominent, eloquent and graceful figure in the Cape Parliament and public life of South Africa. At one time, in the early nineties, for about a year, he was business manager on Langlaagte Estate gold mine, near Johannesburg.

New Machinery and Inventions



8-ton gasoline locomotive with elliptic springs and cross-equalizers

Gasoline Locomotives Improved

Announcement has just been made by the Vulcan Iron Works, of Wilkes-Barre, Pa., that they are now prepared to furnish their gasoline locomotives in all sizes from 8 tons up equipped with elliptic springs and cross-equalizers, giving three-point suspension of the chassis. With this design derailment is a rare occurrence inasmuch as the weight of the locomotive is always equalized on all the bearings regardless of any unevenness or irregularities in the track. Three-point suspension is standard practice on all steam locomotives.

Circuit Breaker Localizes Feeder Outages

A new single-pole circuit breaker just announced by the Ohio Brass Co. is a combination circuit breaker and single-pole switch completely enclosed in an insulating case. It is a device for sectionalizing power and trolley circuits at butt headings, the entrance of each of a group of small mines working from one power house, or for any distribution arrangement where a branch circuit handles current for a number of locomotives. The use of such a switch properly located prevents local overload or short circuit conditions from interrupting the whole power system as is the case if the main circuit breaker in the power house is the only protection.

With this device the overload protection is placed close to the point of use of the electric power and it can be set to protect the motors and cables affected more accurately and certainly.

The normal rating of this device is 500 amp., and it permits an intermittent overload of 50 per cent. The overload current trip is made by means of an armature actuated by the excessive current in the trip coil. Adjustment between 200 and 800 amp. is provided by a spring setting on the armature.

The O-B circuit breaker completely cuts off current and voltage. It is opened by overload or manual tripping; it will not reclose itself unless the operator throws the handle to the connection position. The breaker does not have low voltage protection; in other words, in case of failure of voltage from the power side, it will not automatically open. In such cases, return of the power will find the breaker still closed and energy available out at the end of the line.

The mechanism is entirely enclosed in a case made of Dirigo molded insulation. The operating handle is soft rubber. The mechanism consists of a single-pole circuit breaker contactor and a single-pole knife switch, the two being connected in series. They are both arranged to be operated from the same handle, and are so interlocked mechanically and electrically that their sequence of action is always such as to make and break the current on the breaker contacts and not on the knife switch.

This new breaker can also be used for protection of mine locomotive motors, by installing a breaker on each locomotive and setting it to trip at a predetermined current valve.

Oil Burner of New Design

F. Beers & Co., Newark, N. J., are marketing a new design of oil burner called the P. & B. This burner, which is of simple construction, operates on the steam atomizing principle. It is said to require but 1.3 per cent of the steam generated for operation.

By the design of this burner, the parts that are liable to become heated are jacketed by the incoming steam, which results in preventing overheating by the steam absorbing excess heat. Within the burner the incoming oil enters in four jets, which are encountered by four jets of steam at right angles, the atomization taking place at this point. From this point the steam of atomized oil and steam passes through a nozzle and enters the burner for combustion.

This burner has been designed for compactness, and projects but a small distance into the furnace. It has no parts to adjust, and no moving parts.

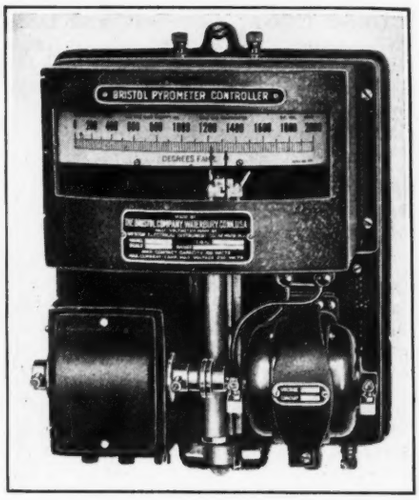
On a recent test, the manufacturers say that with 75-lb. oil pressure and 120-lb. steam pressure, with oil at 120 deg. F., 14 Bé. gravity, with four ¼ in. by $\frac{3}{64}$-in. steam ports and four ¼ by $\frac{1}{16}$-in. oil ports, and a ⅛ in. by $1\frac{3}{16}$-in. burner tip, one of these burners developed 1,000 boiler horsepower per hour maximum. The same burner is said to have developed a minimum of 25 boiler horsepower per hour while giving a steady fire.

The burners can be altered for both larger and smaller capacity by changing the oil and steam ports, and also the tip opening.

Heat Maintained at Exact Temperature Desired

The Pyrometer controller Model No. 479, shown in the accompanying illustration, recently was placed on the market by the Bristol Co., of Waterbury, Conn. This instrument is fitted with an extra wide scale, motor drive and external contactor adjustment. Simultaneously the working parts have been made readily accessible for adjustment, inspection, oiling or repair. A governor is provided to regulate the speed of the driving motor, which is connected to the main shaft through a non-metallic coupling.

One advantageous detail of this instrument is the safety-adjusting mechanism for setting the position of the index at the point to which it is decided to bring the temperature. A small hinged cover incloses the adjusting knob. This knob, therefore, cannot be operated until the cover is opened, and opening the cover automatically forces the switch mechanism to its lowest position, free from the pointer. With this provision there is no possibility for the operator to damage the millivoltmeter movement.



Automatically controls heat

This instrument may be pre-adjusted to the temperature that it is desirable to maintain. All parts are readily accessible for inspection, lubrication or repair.

This controller is designed for use with oil, gas or electrically heated equipment, such as ovens, furnaces, and the like. It can be used on any temperatures up to 3,000 deg. F.

Trade Catalogs

Valves—Bulletin No. 20 of the Thyle Machinery Co., San Francisco, Calif., describes a new size of Bradley automatic density valve, type "C" intended to permit automatic control of underflow. Several new features are said to be incorporated in this type.

Stoker — Combustion Engineering Co., New York, has issued catalog C4 covering the Coxe traveling grate stoker.

Railway Equipment—United Commercial Co., 234 Steuart St., San Francisco, Pacific Coast representatives for Hyman-Michaels Co., Chicago, has issued a bulletin, No. 302, containing a list of the second-hand railway track equipment, locomotives and cars and rails included in their line.

Engine Indicators—Bulletin 261 of the Bacharach Industrial Instrument Co., Pittsburgh, Pa., covers Bacharach engine indicators of the Maihak type. The latest Maihak development is a high-speed indicator suitable for speeds up to 2,400 r.p.m.

Welding—General Electric Co., Schenectady, N. Y., has issued several new bulletins including two (GEA-452 and GEA-453) on automatic arc welding apparatus, and GEA-394 on induction motor generator sets, from 1 to 35 kw.

The Market Report

Metal Market Greatly Improved

Zinc and Copper Sales Much Heavier—Tin Prices Touch New Post-War Peak

New York, Sept. 15, 1926—The expected September buying movement in copper has apparently set in, for the volume of sales in the week ending today has been the largest since the active weeks of July. Zinc, also, has been in heavy demand. Tin prices reached 69¾c. for prompt Straits today, again the highest since 1919, with prospects of further advances. Silver has held its own in a quiet market, and lead has been somewhat weaker.

Buyers Pounce on Cheap Copper

Following six weeks of comparative idleness, when the total of sales was only about half what it was in the same six weeks' period last year, buyers again entered the market in the week ending today, and made the heaviest purchases since the week ending July 28. Monday was a particularly heavy day. Producers generally have shown a willingness to meet the market as set in the small sales of the week before. Most of the business has been placed at 14.25c., delivered New York district; 14.30@14.375c., Connecticut; and 14.40 @14.50c., in the Middle West. Even after the heavy sales of Monday and the good business of Thursday and Friday, these prices still prevailed. However, should the buying keep up, prices are expected to work back quickly to the level that was reached at the close of the last buying movement. Most of the orders have been placed for October delivery, confirming the statement made in these columns last week that consumers were poorly covered for that month. A little September copper was also in demand, and about a quarter of the total sales were for November delivery or later.

Consumption continues excellent, but manufacturers report that the volume of advance orders has not been quite so large of late, which has caused them to be more conservative in buying copper. Statistics issued during the week showed stocks of blister and refined in North and South America as 326,251 tons, a decrease of 15,500 tons from the month before, and stocks in other countries also show a declining tendency, without exception. United States mine production for August is not yet available, but blister copper production increased only slightly, from 82,938 tons in July to 84,029 in August.

The export market has been quiet. Yesterday, American agencies reduced their prices to 14.50c., c.i.f., in order to compete with dealers' offerings.

Lead Finally Reduced—to 8.75c., New York

The American Smelting & Refining Co. was finally compelled to take action to kep out foreign bullion as a result of the recent declines in London lead prices, and on Monday, Sept. 13, reduced its contract price of New York lead from 8.90c., which has obtained since July 30, to 8.75c. Following this the London market has been stronger, which is encouraging. Some business resulted on the day of the cut, but yesterday and today the market has been distinctly quiet. The total sales for the week have been well below normal. The principal producer in the Middle West reduced the St. Louis quotation to 8¼c., which price has been generally obtained by others, though slight concessions have been made in some instances. Consumers, however, have not been easily tempted.

Galvanizers After Zinc

Not in months has the volume of zinc business been so heavy as during the last week, all producers reporting exceptional business, principally to gal-

Daily Prices of Metals

Sept.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
9	14.05	65.625	67.75	8 875	8.60	7.375@7.45
10	14.10	66.00	68 25	8 85	8.55@8.60	7.425@7.45
11	14.10	66.50	68 75	8.75@8.90	8.55@8.60	7.45@7.475
13	14.10	67.125	69.25	8.75	8.475@8 50	7.45@7.475
14	14.10	66.625	68.875	8.75	8 50	7.425–7.475
15	14.075	67.50	69.75	8.75	8 50	7.45
Av.	14 088	66 563	68.771	8.800	8 540	7.446

The prices correspond to the following quotations for copper delivered: Sept. 9th, 14.30c.; 10th, 11th, 13th and 14th, 14.35c.; 15th, 14.325c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
9	59	59⅜	66¾	302½	295¼	32 3/16	31 13/16	34 1/16	34⅜
10	58⅞	59⅜	66¾	305¼	296½	31 15/16	31 9/16	34 3/16	34 7/16
13	58⅞	59⅜	66¾	309½	298½	31⅞	31 9/16	34 3/16	34⅜
14	58½	59⅜	66¾	307¾	297¾	31 15/16	31 9/16	34 3/16	34⅜
15	58¾	59½	66¾	310½	299½	32 3/16	31 11/16	34¼	34 5/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver		Gold London	Sept.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
9	4.84 15/16	61¾	28⅜	84s11½d	13	4 85	61¾	28 5/16	84s11½d
10	4.84⅞	61¾	28¼	84s11½d	14	4 85	61⅝	28 5/16	84s11d
11	4.85	61¾	28 7/16		15	4 84⅞	61⅜	28⅛	84s10½d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

vanizers. There has been a pronounced aversion to paying more than 7.45c. however, though some sales were made at 7.475c. The very favorable statistics have increased the purchases without having much effect on price. The business has been well divided between September and October, with a little placed for further forward. The statistics issued by the American Zinc Institute follow, in tons of 2,000 lb.

Stock, Aug. 1	22,986
Produced	51,761
Shipped	56,583
Stock, Aug. 31	18,164
Shipped from plant for export	4,397
Stored for customers	347
Retorts operating Aug. 31	84,584

High-grade zinc continues firm at 9c., delivered in the East. Brass Special has been in modest demand.

Tin Close to 70c.

London operators continue to boost tin and the market here follows. Business was fairly active on Monday but consumers are not buying except for actual needs. Today another high record price, 69¾c., was paid for prompt Straits, and followers of the market would not be surprised to see the quotations even higher. Forward tin is quoted at from 2 to 3¼c. less than prompt.

Silver Quiet

The silver market has had a weak tendency. India and China have not been active buyers but on the other hand there has been no pressure to sell at the lower quotations. The market closes dull and uncertain.

Mexican Dollars (old Mexican pesos) —Sept. 9th, 10th, 11th, and 13th, 47c.; 14th, 46⅞c.; 15th, 46⅝c.

Foreign Exchanges Quiet

No important feature has characterized the principal European exchange markets. Closing cable quotations on Tuesday, Sept. 14, were as follows: Francs, 2.8675c.; lire, 3.605c.; and marks, 23.82c. Canadian dollars, $\frac{3}{64}$ per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Both 98 and 99 per cent grades quoted at 27c. per lb. London, £118 per long ton for domestic metal.

Antimony—Per lb., duty paid, New York: Chinese brands, spot, 16¼c.; forward positions 16½c. Cookson's "C" grade, 18¼@18½c. Needle and oxide nominally unchanged from quotations in the Sept. 4 issue.

Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., New York, 60c. London, 1s. 10½d. for American metal; 1s. 9d. for Australian metal.

Iridium—Per oz., $125@$135 for 98 @99 per cent. Firm. London, £63@ £65 in iridio-platinum.

Nickel—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton according to quantity.

Osmium—Per oz., $55@$65. London, £17@£20.

Palladium—Per oz., $66@$70. Pure metal as a constituent of crude platinum, $50@$55 per oz. London £12@ £15, nominal.

Platinum—Official price on refined metal, $118 per oz. Open market cash sales of large lots, $112@$113. Pure metal as a constituent of crude platinum, $109@$110.

London, £23½ per oz. for refined and £21@£22 for crude.

Quicksilver—Per 75-lb. flask, $89.50 @$91. San Francisco wires $89.33; steady. London, £15⅝.

Ruthenium—Per oz., nominally $50@ $60.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Radium, Rhodium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the issue of Sept. 4.

Metallic Ores

Tungsten Ore—Per unit of WO_3, N. Y.: Wolframite, $10.50@$10.75; Western scheelite, $11@$11.25. Firmer.

Chrome, Iron, Manganese, Molybdenum, Tantalum, Uranium, and **Vanadium Ores** are unchanged from quotations in the Sept. 4 issue.

Unchanged Prices for Zinc and Lead Ore

Joplin, Mo., Sept. 11, 1926

Zinc Blende	Ton
High	$53.80
Premium blende, basis 60 per cent zinc	$51.00@$52.00
Prime Western, basis 60 per cent zinc	$50.00
Fines and slimes, basis 60 per cent zinc	$49.00@$46.00
Average settling price, all blende	$48.60
Lead Ore	
High	$115.10
Basis 80 per cent lead	112.50
Average settling price, all lead	111.92

Shipments for the week: Blende, 17,324 tons; calamine, 71; lead, 3,698. Value, all ores the week, $1,258,300.

Sellers feel the market should show an improvement, with practically all of the zinc above ground sold a week ago. Short selling this week left a small unsold tonnage, but more than enough to balance this tonnage has been sold in advance of its production. It is rumored that the lead price was advanced on certain stocks held for a higher price, in view of the unusually heavy shipment this week, but this could not be confirmed.

Platteville, Wis., Sept. 11, 1926.

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$52.75
Lead Ore	
Lead, basis 80 per cent lead	$112.50

Shipments for the week: Blende, 1,064 tons; lead, 80 tons. Shipments for the year: Blende, 38,416; lead, 1,446 tons. Shipments for the week to separating plants, 1,780 tons blende.

Non-Metallic Minerals

Fluorspar—In *New Mexico;* 85-5 gravel, $16 per ton; lump, $16.50; ground, 100 mesh, $35. Market good. Other fluorspar prices unchanged from Sept. 4 issue.

Magnesite—Per short ton, f.o.b. California mines, grade "A" calcined, 80 per cent through 200 mesh, white, for plastic purposes, $45 per ton. Market fair.

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Sept. 4 issue.

Mineral Products

Arsenious Oxide (White Arsenic)—3½c. per lb. Demand continues fairly good and supplies decreasing but prices show no change. London, £13 per long ton.

Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and **Zinc Oxide** are unchanged from prices in the Sept. 4 issue.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $88@$95 per long ton, furnace, prompt and future. Spiegeleisen unchanged from Sept. 4 issue.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from prices in the Sept. 4 issue.

Metal Products

Rolled Copper—Per lb., sheets, 23c.; wire, base price, 16¼c.

Lead Sheets, Nickel Silver, Yellow Metal, and **Zinc Sheets,** are unchanged from the prices in the Sept. 4 issue.

Refractories

Chrome Brick—$50 per ton, f.o.b. shipping point.

Magnesite Brick—$65@$70 per ton for 9-in. straights, f.o.b. works.

Silica Brick—$43 per M, *Pennsylvania* and *Ohio;* $52@$55, *Alabama* and *Illinois.*

Fireclay Brick and **Zirkite** are unchanged from quotations in the Sept. 4 issue.

Iron and Steel Prices Unchanged

Pittsburgh, Sept. 14, 1926

Steel ingot production in August proved to be above all estimates, being 4,004,583 long tons, representing 85.78 per cent of assumed capacity. The gain over July was almost 10 per cent, August showing the largest production since April. Present indications are for about the same high rate this month. Production in the year to Sept. 1, is 10.5 per cent above that in the same period of last year, making an indication that 1925, itself a record year, will be passed by nearly if not quite 10 per cent.

The remarkable demand for oil- and gas-well material has continued, giving the pipe mills a very full operation. Steel prices are firm all along the line.

Pig Iron—The Valley market is still irregular. Bessemer, $18@$19; basic, $17.50; foundry, $17.50@$18, f.o.b. Valley furnaces.

Connellsville Coke—The spot furnace coke market has not reacted after the holiday. Spot furnace, $3.25@$3.35; spot foundry, $4@$4.50.

Company Reports

Tanganyika Concessions and the Union Miniere

The balance sheet of Tanganyika Concessions Limited for the year ending Dec. 31, 1925, may be summarized as follows:

Liabilities

Capital		
Authorized: 5,500,000 ordinary shares of £1 each....	£5,500,000	
Issued: 4,427,760 ordinary shares.....	4,427,760	
1,072,134 cumulative preference shares, convertible into ordinary at 22s. per share up to June 30, 1927	1,072,134	£5,499,894
Premium account, less ordinary shares issue expenses.....		1,607,542
Creditors and credit balances.....		228,743
Debenture holders, pension fund, and reserve.....		248,490
Profit and loss account.....		543,101
		£8,127,500

Assets

Cash, bonds, loans, and debtor balances.....	£1,579,126
Shares and debentures of other companies as follows: 2,700,000 shares of £1 each and £1,162,400 5 per cent debentures in the Benguella railway; 103,048 shares of 100 fr. each, 78,000 dividend shares, 8,642 privileged shares of 500 fr. each, and 61,384 4½ per cent "Obligations" of 100 fr. each, in the Union Minière du Haut-Katanga; 494,814 ordinary shares of £1 each, and 62,450 "B" shares of 1s. each, in the Rhodesia-Katanga Junction Railway and Mineral Co., Ltd.; 1,600 shares of 250 fr. each in the Cie. du Chemin de Fer du Katanga; 10,750 shares of £1 each in the Nile-Congo Divide Syndicate, Ltd., and sundry shares and debentures of other companies.....	5,085,153
Buildings, stores, prospecting expenditure, etc.....	13,783
	£8,127,500

The profit and loss account may be summarized as follows:

Dr.	
London management and general expenditure.....	£29,484
Directors' and trustees' fees.....	21,665
African management and engineering fees.....	7,000
Payments to Kindelungu-Lualaba Exploration committee written off	13,519
Net general expenditure in Africa.....	16,048
Transferred to staff pension fund.....	10,000
Carried to balance sheet.....	727,877
	£825,593
Cr.	
Transfer fees, etc.....	£11,530
Dividends on shares, interest, and other receipts.....	367,908
Profit on sale of shares.....	446,155
	£825,593

A translation of the balance sheet of the Union Minière du Haut-Katanga follows, in condensed form:

Assets

Capital expenditure.....	Fr. 153,024,591
Cost of debenture issue.....	1,716,688
Material and stores.....	70,521,552
Securities in other companies.....	43,996,633
Stocks of ores and metals.....	166,860,279
Sundry debts.....	102,240,196
Bills receivable.....	12,610,261
Cash.....	182,991,290

Liabilities

Capital stock:		
264,000 dividend shares, no par value, in payment for the concessions and equivalent to a royalty of half the profits.		
264,000 capital shares of 100 fr. each.....	Fr. 26,400,000	
200,000 preference shares, 6 per cent, 500 fr. each	100,000	
Premiums received, less expense of issue.....	147,600	
		Fr. 274,000,000
Reserves.....		13,331,387
Debentures, 200,000 4½ per cent of 100 fr. each, and 38,400 7 per cent of 1,000 fr. each.....		58,400,000
Sundry creditors.....		256,295,143
Debentures to be redeemed and coupons on securities.....		9,713,750
Bills payable.....		2,330,440
Profit and loss account.....		119,890,769

Profit and Loss Account

Gross working profits for 1925.....	146,990,218
Balance brought forward from 1924.....	769,529
	Fr. 147,759,747
Deductions for interest, commissions, etc.....	27,868,978
Balance of profit for allocation.....	Fr. 119,890,769

Of this amount, 18,008,974 fr. was carried forward; coupon No. 4 on the preference shares, of 30 fr. will be paid; and a dividend of 175 fr. per share on the Capital and Dividend shares.

Recent Tanganyika dividends have been: a preference dividend for the year ending June 30, 1925, amounting to £123,224; ordinary interim dividend at 5 per cent for the year 1925, amounting to £213,685; the preference dividend for the year to June 30, 1926; a final dividend of 2½ per cent on the ordinary shares, making 7½ per cent for the year; and a proposed interim dividend on the ordinary shares, of 1s. per share, for 1926.

The following items from the directors' report of the Union Minière are of interest:

Reasons for Low Copper Prices

Recent low copper quotations may be attributed to two main factors: the disturbed economic situation of the world, and the defective methods of selling the metal. With a view to improving the selling conditions in Europe, our company has recently participated in the creation of an organization embodying about 90 per cent of the world's copper producers, the object of which is to facilitate direct transactions between producer and consumer.

During the year, 23,624 meters of drilling have been done for prospecting purposes, as a result of which the Kipushi (Prince Leopold), Lukuni, and Luushia-Extension mines have been opened up and will commence production during 1926. Ore reserves proved up to Dec. 31, 1925 were:

Oxide ores	Metric Tons	Per Cent. Copper	Metric Tons Copper
For smelting.....	5,059,000	19	960,000
For leaching and concentration.....	54,273,000	6½	3,526,000
Low-grade ore.....	3,316,000	2.8	94,000
Sulphide and complex ores.....	14,244,000	5	711,000
Total and average.....	76,893,000	6.9	5,286,000
Total at the end of 1924.....	74,687,000	6.7	4,998,000
Copper ore mined during the year.....	1,388,453	....	90,104

The Panda concentrator treated 1,195,736 metric tons of ore, producing 209,159 metric tons of concentrates of an average grade of 24.12 per cent copper. An experimental flotation plant for the treatment of concentrator tailings and low-grade ores, started during the year, treated 89,337 metric tons of tailings, and produced 15 035 metric tons of concentrates of an average grade of 25.3 per cent copper.

The Lubumbashi blast furnaces treated the following charge:

	Metric Tons
Ores, concentrates, and agglomerates.....	429,203
Fluxes (limestone, 172,245; iron ore, 91,455).....	263,700
Coke (30 per cent of ore: 18½ of charge).....	128,553

The sintering ovens supplied 45,899 metric tons of sinter. An experimental reverberatory furnace ran 264 days, smelting 32,315 metric tons of concentrates, and producing 7,370 metric tons of copper, Leaching tests were carried out, treating 15,062 metric tons of ore and producing 1.362 metric tons of cathodes, to act as a guide to treatment in the large leaching plant now being erected at Panda. Electro-thermic smelting on an experimental scale produced 290 metric tons of copper ingots. Total copper production for the year amounted to 90,104 metric tons compared with 85,570 in 1924; 57,886 in 1923; 43,362 in 1922; 30,464 in 1921; and 18,962 in 1920.

The Busanga mine produced 854 metric tons of cassiterite, which was smelted by the Hoboken Metallurgical Co. in Belgium. Electric-furnace production of cobalt alloy amounted to 683.5 metric tons, which was shipped to the Cobalt plant at Oolen, Belgium. Commercial agreements were made for the marketing of this product. About 20 grams of radium were produced during the year by the radium plant at Oolen. This was about 80 per cent of the world's consumption.

Among the plants under construction are: a reverberatory furnace plant with a capacity of 30,000 to 40,000 metric tons of copper per year; an electrolytic leaching plant of a capacity of about 30 000 metric tons: power plants, a flotation plant, powdered coal plant, brick-making plant, repair shop, and housing accommodations. The electrolytic refinery at Oolen is under way, its potential capacity having been increased to 65,000 metric tons of electrolytic copper per year. The Bukama-Ilebo railway line is expected to be completed in 1928, and the construction of the railway from Lobito Bay toward Katanga is well in hand. Emphasis is placed on the necessity of having several alternate routes to the seacoast.

The labor difficulties were dealt with at some length, and were mentioned editorially in *Engineering and Mining Journal* of Aug. 7, 1926.

The head office of the Union Minière du Haut-Katanga is at Elisabethville, Katanga, Belgian Congo, and the administrative office, 3, Rue de la Chancellerie, Brussels, Belgium.

Mining Stocks—Week Ended September 11, 1926

Stock	Exch.	High	Low	Last	Last	Div.
COPPER						
Anaconda	New York	50⅞	49⅛	49⅛	Jy.17, Au.23 Q	0.75
Arcadian Consol.	Boston	1	1	1		
Ariz. Com'l	Boston	11⅜	11⅛	11⅛	Jy. 16, Jy. 30	0.50
Calaveras	N. Y. Curb	1¼	1¼	1¼		
Calumet & Arizona	New York	70	70	70	Se. 4, Se. 20 Q	1.50
Calumet & Hecla	Boston	18	16½	18	Au.31, Se.15 Q	0.50
Cerro de Pasco	New York	71½	69⅜	69⅜	Jy. 15, Au.2, Q	1.00
Chile Copper	New York	34	33¼	33⅜	Se.1, Se.27, Q	0.62½
Con. Coppermines	N. Y. Curb	3¼	3	3⅛		
Copper Range	Boston	17	16¼	16¼	May, 1925	1.00
Crystal Copper	Boston Curb	*39	*38	*39		
East Butte	Boston	3¼	3	3¼	Dec., 1919	0.50
First National	Boston Curb	*17	*16	*16	Feb., 1919	0.15
Franklin	Boston	*30	*30	*30		
Granby Consol.	New York	28⅞	25⅜	27⅜	May, 1919	1.25
Greene-Cananea	New York	21	20⅛	20⅛	Nov., 1920	0.50
Hancock	Boston			1		
Howe Sound	New York	42	40	41½	Jy.1, Jy.15	0.75
Inspiration Consl.	New York	25⅛	25	25	Se.16, Oc.4, Q	0.50
Iron Cap	Boston Curb	3⅛	3⅛	3⅛	Jn. 1, Jn. 15	0.50
Isle Royale	Boston	13	12⅛	12⅛	Jn. 1, Jn. 15	0.50
Jerome Verde Dev.	N. Y. Curb	*73	*58	*58		
Kennecott	New York	57⅛	56⅛	56⅛	Sept. 3, Oct. 1 Q	1.00
Lake Copper	Boston	1	1	1	June, 1925	0.50
Magma Copper	New York	40⅞	39⅛	39⅛	Jn.30, July. 15, Q	0.75
Mason Valley	N. Y. Curb	2⅛	2⅛	2⅛		
Mass Consolidated	Boston	*40	*40	*40	Nov., 1917	1.00
Miami Copper	New York	15⅛	14⅛	14⅞	Aug.2, Aug.16 Q	0.25
Mohawk	Boston	42	40⅜	41⅛	Jy.31, Se.1 Q	1.00
Mother Lode Coa.	New York	6⅛	6	6⅛	Jn. 15, Jn. 30	0.37½
Nevada Consol.	New York	13⅞	13⅜	13⅞	Oc.14, Nov.16 Q	0.75
New Cornelia	Boston	22⅛	22⅛	22⅛	Au.6, Au.23 Q	0.04
Ohio Copper	N. Y. Curb	*56	*56	*56	Se. 1, Se. 15	0.05
Old Dominion	Boston	18	17	17	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†138	†136		Jun.22, July2 Q	1.50
Quincy	Boston	21	20½	20½	Mar., 1926	1.00
Ray Consolidated	New York	14½	14	14	Ap.20, Ap.30	0.25
Ray Hercules	N. Y. Curb			11⅞		
St. Mary's Min. Ld.	Boston	31½	30½	31½	Ap.17, My.18	2.00
Seneca Copper	New York	5⅜	5⅛	5⅛		
Shannon	Boston	*40	*40	*40	Nov., 1917	0.25
Shattuck-Denn	Boston Curb	6⅞	6⅜	6⅜		
Superior & Boston	Boston			65		
Tenn. C. & C.	New York	11⅛	11	11	Au.31, Se.15, Q	0.25
United Verde Ex.	N. Y. Curb	27⅞	27⅛	27⅛	Jy.17, Aug. 2,	0.75
Utah Copper	New York			104½	Se.3, Se.17 Q	1.75
Utah Metal & T.	Boston	1⅜	1⅛	1 1/16	Dec., 1917	0.30
Victoria	Boston	*50	*50	*50		
Walker Mining	Salt Lake	*71	*70	*71		
NICKEL-COPPER						
Internat. Nickel	New York	38⅜	36	36	Se.7, Se.30, Q	0.50
Internat. Nickel, pfd.	New York			102	Jy.12, Au.12,	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*31½	*30½	*31½	Jy. 10, Au.10	0.01½
National Lead	New York	159½	158	158	Jn. 11, Jn. 30 Q	2.00
National Lead pfd.	New York			117½	My.21, Je.15 Q	1.75
St. Joseph Lead	New York	43⅛	42⅛	42⅛	Jn.10, Jn.21 QX	0.75
ZINC						
Am. Z. L. & S.	New York	7⅛	7⅛	7⅛	May., 1920	1.00⅞
Am. Z. L. & S, pfd.	New York	35	33½	34	Nov., 1920	1.50
Butte C. & Z.	New York	4⅛	4⅛	4⅛	De.10, De.24	0.50
Butte & Superior	New York	11	10⅛	10⅛	Se.15, Se.30 Q	0.50
Callahan Zn-Ld	New York	1⅛	1⅛	1⅛	Dec., 1920	0.50
Eagle Picher	Cincinnati	32½	32⅛	32⅛	Au.14, Se.1 Q	0.40
Eagle Picher, pfd.	Cincinnati			110	Aug.20, Sept.15 Q	1.75
New Jersey Zn.	N. Y. Curb			191	July20, Aug.10 Q	2.00
North Butte	Boston	2⅛	2⅛	2⅛	Oct., 1918	0.25
United Zinc	N. Y. Curb			*70		
Yellow Pine	Los Angeles	*15	*12½	*12½	De.8, De.18 Q	0.04
GOLD						
Alaska Juneau	New York			1⅛		
Argonaut	Toronto	*31⅛	*27½	*27½		
Barry-Hollinger	Toronto	*68	*66	*66½		
Carson Hill	Boston			*35		
Consol. W. Dome L.	Toronto	*21½	*20½	*20½		
Cresson Consol. G.	N. Y. Curb	2⅛	2 7/16	2 7/16	Mh.31, Ap.10	0.10
Crown Reserve	Toronto	* 9½	*9	*9	Jan., 1917	0.05
Dome Mines	New York	11⅛	10⅞	11⅛	Jn.30, July 20, Q	0.50
Golden Center	N. Y. Curb	2⅛	1⅞	1⅞		
Golden Cycle	Colo. Springs			2	Nov.30, Dec.10 Q	0.03
Hollinger Consol.	Toronto	19.45	19.25	19.30	Au.24, Se.9 Q	0.10
Homestake Mining	New York			58	Se.20, Se.25 M	0.50
Kirkland Lake	Toronto	1.21	1.11	1.21		
Lake Shore	Toronto	14.90	14 60	14.70	Se.1, Se. 15 Q	0.10
McIntyre-Porcupine	New York	25⅝	25⅜	25⅜	Au.2, Se.1 Q	0.25
Newray	Toronto			*40		
Noranda	N. Y. Curb	19½	19	19		
Night Hawk Pen.	Toronto	*7	*6½	*6½		
Portland	Colo. Springs			*43½	Oc.6, Oc.15	0.02
Rand Mines	New York			36½	Au.23–30 Am.Sh.	1.52
Teck-Hughes	Toronto	4.77	4 66	4.71	Jy. 15, Au. 2	0.05
Tom Reed	Los Angeles	*66	*65	*65	Ma.10 Ma.20	0.02
Tough-Oakes	Toronto	*48	*47	*47		
United Eastern	N. Y. Curb			*48	July, 1924	0.05
Vipond Cons.	Toronto	1.84	1.77	1 80		
Wright-Hargreaves	Toronto	8.85	8.60	8 75	Se.15, Oc.1 QX	0.07½
Yukon-Alaska Trust	N. Y. Curb			21		
GOLD AND SILVER						
Carnegie Metals	Boston			12½		
Con. Cortez	N. Y. Curb			*8		
Con. Virginia	San Francisco	*9½	*8½	*9½		
Continental Mines	N. Y. Curb			*48		
Dolores Esperanza	N. Y. Curb	*100	*77	*77	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅜	2⅛	2⅛	Se.15, Oc.4 Q	0.08
Tonopah Belmont	N. Y. Curb	3⅛	2⅛	3⅛	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb			*46	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	5⅛	5⅛	5⅛	Ap.7, Ap.21 Q	0.07½
Unity Gold	N. Y. Curb			*30		
West End Consol.	N. Y. Curb			*18	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*27	*25	*25	June, 1918	0.02

Stock	Exch.	High	Low	Last	Last	Div.
SILVER						
Alvarado	N. Y. Curb			1	Oct., 1920	0.50
Beaver Consol.	Toronto	*94	*82	*90	May. 1920	0.03
Castle-Trethewey	Toronto	1.44	1.41	1.42		
Coniagas	Toronto	4.35	4.30	4.35	May, 1924	0.12½
Keeley	Toronto	1.64	1.57	1.62	Se.1, Se.15 X	0.12
Kerr Lake	N. Y. Curb	1	1	1	Ap.1, Ap.15	0.12½
La Rose	Toronto	*10	*8	*8	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	*50	*50	*50	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*15	*13	*13	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.85	3.74	3.75	Jy.1, Jy.15	0.12½
Nipissing	N. Y. Curb	6⅞	6½	6½	Jn.30, Jy.20	0.15
Temiskaming	Toronto	*6½	*6½	*6½	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	7⅛	7⅛	7⅛	Jn.18, Jy.5, Q X	0.25
Alta Merger	Salt Lake	†4	†2			
Bingham Mines	Boston	43⅛	42⅛	43⅛	Jn.19, Jn.30 Q	1.00
Cardiff M. & M.	Salt Lake	*35	*35	*35	De.16, No.18	0.10
Chief Consol.	Salt Lake	3.15	3.12½	3.12½	Jy.10, Au 10 Q	0.10
Emma Silver	Salt Lake	†1	†*50			
Erupcion	Boston Curb	1⅛	1⅛	1⅛	Se., Oc.1, QX	0.15
Federal M. & S.	New York	80	80	80		
Federal M. & S., pfd.	New York	76	74⅛	75⅛	Au.25, Se.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*14	*11	*13		
Hecla Mining	N. Y. Curb	17⅛	17⅛	17⅛	Au.14, Se.15 Q	0.50
Iron King Mining	Salt Lake	*43⅛	*20	*43⅛		
Keystone Mining	Salt Lake	29	29	29	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*16½	*16½	*16½		
Lucky-Tiger Com.	Kansas City		†8.90		Se.10, Se.20 X	0.07
Mammoth Mining	Salt Lake	3.05	3.05	3.05	Mar.24, Apr. 1	0.10
Marsh Mines	Spokane	2.75	2.50	2.50	Se.15, Oc.19	0.15
Park Utah	New York	6.40	6.25	6.25	Jn.15, Jy.1 Q	0.15
Plutus Mining	Salt Lake	1.95	1.90	1.95	July 15	0.10
Prince Cons.	Salt Lake	4.25	3.00	4.25		
Silver King Coal.	Salt Lake	8.75	8.50	8.50	Jn. 21, July 1, Q	0.25
Silversmith	Spokane	*50	*49⅛	*49⅛	Jn.30, Jy.10 Q	0.02
Tamarack-Custer	Spokane	*28⅛	*27⅛	*27⅛	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.62½	12.25	12.25	Se.13, Se.25 QX	0.40
Utah-Apex	Boston	8	7⅛	7⅛	Jy.3, Jy.15 Q	0.25
Western Utah Copper	N. Y. Curb			*5		
IRON						
Bethlehem Steel	New York	47⅛	46⅛	46½	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	82	80	82		
Colorado Fuel & Iron	New York	48⅜	44	47⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	21½	21	21	De. 4, De. 28,	0.75
Inland Steel	New York			42	Au.13, Se.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1⅛	1⅛	1⅛		
Replogle Steel	New York	10⅛	10	10		
Republic I. & S.	New York	60⅛	59⅛	59⅛	Au.14 Se.1	1.00
Republic I. & S. pfd.	New York			98⅛	Se.15, Oc.1 Q	1.75
Sloss-Sheffield S. & I.	New York			133⅛	Se.10, Se.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	105	105	105	Se 20. Oc.1 Q	1.75
U. S. Steel	New York	152⅜	146⅛	146⅛	Se.2, Se.29 Q	1.75
U. S. Steel pfd	New York	127⅛	126⅛	126⅛	Au.3, Au.30, Q	1.75
Virginia I. C. & C.	New York			46⅛	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	72	72	72	Jn.1, July 2,	2.50
ALUMINUM						
Alum.Co.of Amer.	N.Y.Curb	69⅛	69	69		
Alum. Co. of Amer pf.	N.Y.Curb	102	102	102	June 15, July 1, Q	1.50
VANADIUM						
Vanadium Corp.	New York	41	38	40⅛	Au.2, Au.16, Q	0.75
ASBESTOS						
Asbestos Corp., New	Montreal	21⅞	19	21⅛	De.31, Ja.15 Q	1.50
Asbestos Corp., pfd.	Montreal	77	73	76⅛	Jy.1, Jy.15, Q	1.75
SULPHUR						
Freeport Texas	New York	29⅛	27	27	Nov., 1919	1.00
Texas Gulf	New York	170½	166⅛	166⅛	Se.7, Se. 15, Q	3.00
DIAMONDS						
De Beers Consol.	New York			35⅛	Ju.16, Ju.17	1.70
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4⅛	4⅛	4⅛		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	51⅛	50⅛	51	Au.20, Se.1, Q	1.00
Amer. Metal pfd	New York			115⅜	Au.21, Se.1 Q	1.75
Amer. Sm. & Ref.	New York	150	144	144⅛	Jy.10, Au.2, Q	1.75
Amer. Sm.&Ref.pfd.	New York	119	119	119	Au.7, Se.1, Q	1.75
Consol. M. & S.	N. Y. Curb			2.20	Jn.30, Jy.5 QX	3.75
Federated Metals	N. Y. Curb			13		
Newmont Mining	N. Y. Curb	66⅛	65⅛	65⅛	Mar.31, Apr.15,	0.60
Southwest Metals	N. Y. Curb			1		
U. S. Sm. R. & M.	New York	38⅛	38	38	Jy. 7, Jy. 15, Q	0.87½
U. S. Sm. R.&M.pfd.	New York	49⅛	48⅛	49	Jy. 7, Jy. 15, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED AUGUST 31, 1926

Name	High	Low	Last		Last Divd Date	Amoun
Aramayo Mines (25 frs.)	80/—	77/10½	78/—	Aug.	1926	15 p.c.†
British Platinum (£1)	4/6	4/—	4/—	Feb.	1925	2½ p.c.
Burma Corpn. (10 rupees)	16/4½	15/4½	15/6	Aug.	1926	7 annas*
Bwana M'Kubwa (5s)	7/6	6/9	7/3			
Camp Bird (2s)	4/4½	4/3	4/3			
El Oro (£1)	8/6	8/—	8/3	Nov.	1924	2½ p.c.*
Esperanza (10s)	1/1½	—/9	—/9			
Frontino & Bolivia (£1)	7/6	6/6	7/6	July	1926	2½ p.c.
Mexican Corpn. (£1)	14/6	13/7½	14/—			
Mexico Mines of El Oro (£1)	26/3	25/—	25/—	June	1926	7½ p.c.*
Oroville Dredging (£1)	3/9	3/6	3/9	ec.	1923	3½ p.c.
Ouro Preto (£1)	2/1½	2/—	2/1½	May	1925	2½ p.c.
Rhodesian Congo Border (£1)	113/1½	107/6	110/—			
St. John del Rey (£1)	9/6	9/—	9/3	June	1925	6½ p.c.
San Francisco Mines (10s)	33/3	31/4½	33/—	June	1926	15 p.c.
Santa Gertrudis (£1)	18/4½	16/9	18/3	July	1925	5 p.c.
Selukwe (2s. 6d.)	12/6	12/—	12/1½	April	1917	6¾ p.c.
S. Amer. Copper (2s.)	4/4½	4/—	4/3	Nov.	1917	75 p.c.
Tanganyika (£1)	46/—	40/—	44/4½	Aug.	1926	7½ p.c.
Tomboy (£1)	3/6	3/3	3/6	July	1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.500	9.300	9.490	July	1926	175 frs.‡

* Free of British income tax. † Swiss frs. ‡ Belgian frs.